

THE VULNERABILITY OF THE UNITED STATES  
RAILROAD SYSTEM TO TERRORIST ATTACKS

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by

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

## ABSTRACT

### THE VULNERABILITY OF THE UNITED STATES RAILROAD SYSTEM TO TERRORIST ATTACKS, by Clayton D. Franks, 235 pages.

This research focused on the vulnerability of the United States railroad system to terrorist attacks. This research of the railroad system was restricted to long-distance passenger rail (Amtrak) and freight rail. Commuter rail (subways) and Light rail were not considered. This paper examines research regarding how the United States compares in different areas on a global scale and considers options that could mitigate or increase terrorist attacks on the railroad system that is shown to be vulnerable and a primary target for terrorist attacks. The vulnerabilities and threats to passenger and freight rail and the current levels of protection for each are assessed. The paper also reviews the types of threats that could be delivered, how passenger and freight rail are most susceptible to terrorist attacks, and how terrorists could cause the maximum amount of damage and loss of life. The results of this research indicate that the present levels of protection are insufficient, additional levels of protection could be implemented, and that there is a need for contingency plans to protect the railroad system in the event a major attack occurs.

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## ACRONYMS

AAR	American Association of Railroads
AIT	Advanced Imaging Technology
APD	Amtrak Police Department
ATS	Automated Targeting System
BASS	Behavior Assessment Screening System
BNSF	Burlington Northern Santa Fe Railroad
CBP	Customs and Border Protection
DHS	Department of Homeland Security
DOD	Department of Defense
DOT	Department of Transportation
FBI	Federal Bureau of Investigation
FRA	Federal Railroad Administration
GAO	Government Accountability Office
GTI	Global Terrorist Index
HHFT	High-Hazard Flammable Train
HSR	High Speed Railway
IED	Improvised Explosive Device
NEC	Northeast Corridor
NTSB	National Transportation and Safety Board
PTC	Positive Train Control
RAIL SAFE	Regional Alliance Including Local State and Federal Efforts
SPOT	Screening of Passengers by Observation
TIH	Toxic Inhalation Hazard

TSA	Transportation Security Administration
UAS	Unmanned Aircraft System
UAV	Unmanned Aerial Vehicle
UP	Union Pacific Railway
VBIED	Vehicle-Borne Improvised Explosive Device
VIPR	Visual Intermodal Protection and Response



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## CHAPTER 1

### INTRODUCTION

#### Background

The unlawful use of violence or threat of violence, often motivated by religious, political, or other ideological beliefs, to instill fear and coerce governments or societies in pursuit of goals that are usually political.

—Joint Chiefs of Staff, Joint Publication 1-02, *Department of Defense Dictionary of Military and Associated Terms*

Since the tragic attack on the United States of America on September 11, 2001, the security of our nation's transportation system has been under scrutiny. For years, our nation has wondered if it was safe to board an airplane and travel across the country or around the world. The United States Congress created the Department of Homeland Security (DHS), Transportation Security Administration (TSA), passed many acts and bills, and reportedly has appropriated hundreds of billions of dollars since September 11, 2001 in an attempt to identify and mitigate the potential security threats to our transportation system.

The Department of Transportation (DOT) is responsible for six modes of transportation: aviation, rail, maritime, transit, land (roads), and pipelines. It is possible that the security efforts put forth have mainly focused on our aviation system, and equal priority has not been afforded to the other modes of transportation. Since the attacks came through the aviation system, a large portion of the media reports, public demand, and government funding have focused on making our aviation system secure. The effects of terrorism through our nation's aviation system did leave marked negative impacts on our economy and, in many ways changed how we now go about our daily lives.

The purpose of this research will focus on the vulnerability of the United States railroad system to terrorist attacks. The research will look at the different methods the United States utilizes to identify vulnerabilities of the railroad system to terrorist attacks and what steps have been taken to mitigate these potential violent and illegal activities. This paper will also research how the United States compares on a global scale to mitigating terrorist attacks on the railroad system, and how it strives to be on the cutting edge of the technology necessary to meet new security challenges. Research and international experiences show that globally, the railroad system is vulnerable and a primary target for terrorist attacks. This could indicate that the United States railroad system is also vulnerable and that preventing railroad attacks needs to be researched and addressed with an even greater level of aggressiveness. As with most everything, this will come with the need of more funds allocated for the security of our railroad system in a now constricted funding environment.

There are many different elements to the railroad system and many different ways to compromise the integrity of those elements. The possibility of threats that are delivered externally or internally toward the industry by attacking any part of the railroad network could bring about the desired effect. Physical destruction by several different methods or the now biggest threat, cyber-attack, could happen on either long passenger or freight rail. The growing likelihood that the train itself could be used as a weapon is becoming more of a reality than just a possibility and one that causes great concern.

The difficult task of identifying the possible attackers is constant and provides a tremendous challenge to stay ahead of the continuously evolving list. An example of several different threat categories but certainly not all-inclusive would be terrorist groups,

disgruntled employees, lone actors, organized crime, and radicalized individuals or groups. Their motivation and goals vary but can range from simply drawing attention to a cause, achieving a political goal, or at the far end of the scale of inflicting mass casualties. Other goals of the railroad terrorist could be to promote a high level of fear that an attack could be random and come without warning, destruction to the rail system, or damage to the country's economy.

The issue becomes even more difficult when trying to anticipate the methods or weapons that could be used to inflict an attack. A high cause for alarm is the possibility of mass casualties by targeting railroad tank cars that carry hazardous materials. An accidental derailment of trains that are transporting tank cars filled with toxic inhalation chemicals or flammable liquids such as oil, has always been a concern. Generally, tanks cars hold up to 20,000 gallons of chemicals such as hydrochloric acid or up to 30,000 gallons of oil each.<sup>1</sup> Now the possibility of intentional derailment or detonation of trains by terrorists carrying these dangerous products in a populated area has multiplied the security risk. Controversy has also erupted over the railroad companies moving these dangerous products through populated areas in a so-called cloud of secrecy. After 9/11, information on the scheduled movement of these products was restricted with the argument of keeping this type of information from those who could use it to cause harm. The people of these urban and rural areas argue that without knowing when the trains are coming through and what they are carrying, they have no chance of protecting themselves in case of an incident involving these dangerous products. Both sides of this issue

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<sup>1</sup> Greenbrier Companies, "Tank Cars," accessed December 4, 2014, [http://www.gbrx.com/Tank\\_Cars.php](http://www.gbrx.com/Tank_Cars.php).

certainly have merit and a solution will require a balance of common sense and the need for protection.

As of now passenger, baggage, and cargo screening of passenger trains is random and a possible major vulnerability to attack by terrorists. Globally it is reported that using some type of bomb is the leading method of terrorist attack and accounts for approximately 75 percent of attacks on passenger trains.<sup>2</sup> The airline industry has dealt with the issues that arise with providing strict security measures. These issues such as delays, privacy rights, and developing new technology have certainly been a challenge for the airlines, but they always have the tragic history of the 9/11 attacks to support their expensive and sometimes problematic systems. However, even with the expense, problems, and delays there are now many extra levels of security that are not present in the other modes of transportation.

In order to protect the millions of passengers that utilize passenger trains annually from a terrorist attack, these airline issues, though similar at one level, are completely different at another and may require a different solution. Is the answer to implement the aviation type screening process where every piece of checked and carry-on baggage, all cargo, and walk through screening is implemented? The DHS now reports that, “As required by the 9/11 Act, 100 percent of all cargo transported on passenger aircraft departing United States airports is now screened commensurate with screening of

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<sup>2</sup> Brian Michael Jenkins and Bruce R. Butterworth, MTI Report WP 09-02, “Explosive and Incendiaries Used in Terrorist Attacks On Public Surface Transportation: A Preliminary Empirical Examination” (Report, Mineta Transportation Institute, College of Business, San Jose State University, San Jose, CA, March 2010), 41, fig. 40, accessed November 3, 2014, <http://transweb.sjsu.edu/MTIportal/research/publications/documents/2875-IED-Support-Research.pdf>.

passenger checked baggage.”<sup>3</sup> If this is needed on long-distance passenger rail, then the challenge will be to maintain the current efficiency, convenience, speed, and overcome public resistance to what some would call an invasion of privacy.

A question that drives the efforts to meet the threat is: Can the current methods of prevention such as, closed circuit television, random screening, high visibility police, and specially trained canine teams withstand a deliberate and well-planned attack on the railroad system? With the patience terrorists have to wait for the right opportunity, adaptability of their methods, and access to technology, we cannot expect to solve today’s problems by applying yesterday’s solutions. Developing new technologies for existing ideas and adapting technologies developed for other industries such as the Unmanned Aerial Vehicle (UAV) or unmanned aircraft systems (UAS) which encompasses additional ground-based support, could provide resources to help meet the needed level of protection. Excluding the derailing in Arizona in 1995 of Amtrak’s Sunset Limited, an act of domestic terrorism, the United States railroad system has been fortunate enough not to be the target of terrorist attack. Many would see this as evidence that the need has been met, but whether by providence or by effort, that school of thought only contributes to the strong resistance that could be faced when trying to implement the costly and stringent security measures that now serve the airline industry.

In December of 2014, the Association of American Railroads (AAR) reported that the nation’s freight railroads spent \$28 billion of their own funds, not taxpayer dollars, to

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<sup>3</sup> U.S. Department of Homeland Security, “Cargo Screening,” accessed December 13, 2014, <http://www.dhs.gov/cargo-screening>.

build, maintain, and upgrade their nationwide rail network.<sup>4</sup> In 2015, that amount is projected to grow to \$29 billion to continue to fund those same areas of development. Over the past 35 years, the freight railroads have infused approximately \$575 billion into the rail system in an effort to conduct a continuous upgrade program for its infrastructure.<sup>5</sup> In 2014, the freight railroads were committed to hiring approximately 12,000 employees, but by years end had exceeded that number and actually hired over 17,000 new employees. Between 2012 and 2014, the railroad hired 45,000 people including an estimated 9,900 men and women with military service.<sup>6</sup>

The TSA describes the freight railroads as a provider that serves nearly every industrial, wholesale, retail, and resource-based sector of the United States economy, and is responsible for transporting a majority of goods and commodities that Americans depend on daily. The Association of American Railroads reports that the United States freight rail system, a \$71 billion industry, moves more freight than any other freight rail system worldwide but also provides 185,000 jobs across the country.<sup>7</sup> Compared to the other modes of transportation, the railroad accounts for and leads the way with 40 percent

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<sup>4</sup> Association of American Railroads, “Overview of America’s Freight Railroads,” May 2015, accessed May 23, 2015, <https://www.aar.org/BackgroundPapers/Overview%20of%20Americas%20Freight%20Railroads.pdf#search=class%201>.

<sup>5</sup> Association of American Railroads, “Rail Investment, Privately Investing In America’s Rail Infrastructure,” accessed December 7, 2014, [www.aar.org/todays-railroads/our-network?t=railinvestment](http://www.aar.org/todays-railroads/our-network?t=railinvestment).

<sup>6</sup> Association of American Railroads, “Freight Railroads Continue Major Hiring Drive, Strong Focus On Veterans,” November 10, 2014, accessed November 30, 2014, <https://www.aar.org/newsandevents/Press-Releases/Pages/Strong-Focus-on-Veterans.aspx>.

<sup>7</sup> Association of American Railroads, “Overview of America’s Freight Railroads.”



of intercity freight volume. What would be the impact to our nation's economy if a terrorist attack did happen to our railroad system and caused delays or even shut down major portions of the railroad system for even a short period?

The Federal Rail Administration reports over 90 percent of products moved by rail freight include agriculture and energy products, automobiles, construction materials, chemicals, coal, food, and metals. Coal is the most important single commodity carried by rail. The vast majority of coal in the United States is used to generate electricity at coal-fired power plants. Coal accounts for approximately 40 percent of all United States electricity generation, more than any other fuel source, yet is now decreasing since 2006, and railroads handle approximately two-thirds of all United States coal shipments. Many other resource providers use the railroads, and depend on the system for timely shipping and receiving of their raw materials and finished products. Interruptions to the rail system would by any measure, have an impact on the nation's economy.<sup>8</sup> Comparing the railroad security standards of the United States to other countries can only benefit the United States by exposing any weak areas that have been either bypassed by risk analysis or simply overlooked.

"The National Railroad Passenger Corporation (better known as Amtrak) is not a government agency, but a government owned for-profit corporation that operates intercity passenger rail services in 46 states and the District of Columbia. Amtrak was created by Congress in the Rail Passenger Service Act of 1970 and assumed the common carrier obligations of the private railroads in exchange for the right to priority access of

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<sup>8</sup> Association of American Railroads, "The Economic Impact of America's Freight Railroads."

their tracks for incremental cost.”<sup>9</sup> Amtrak reports that during fiscal year 2013 the total number of passengers was over 31 million, an average of more than 86,000 passengers on over 300 trains per day. Amtrak reports that there are 2,200 commuter trains using Amtrak-owned infrastructure on the Northeast Corridor (NEC) with an average weekday ridership of 750,000. Amtrak has 23 tunnels consisting of 18.6 miles of track and 1,209 bridges consisting of 42.5 miles of track on the NEC. Of these bridges, 14 of them are moveable bridges between Washington and Boston.<sup>10</sup> Amtrak carried more than three times as many passengers on the route from Washington, DC to New York and the route from New York to Boston than did all of the airlines combined. To the average person these massive numbers would seem to indicate a profitable business. However, Amtrak acknowledges that fiscal year 2012 reports show a revenue income of \$2.877 billion while incurring \$4.036 billion in expenses.<sup>11</sup>

“In Madrid Spain in 2004, ten near simultaneous bombs were detonated, killing 191 and injuring over 2000 passengers. In West Bengal, India in 2010, a sabotaged railroad track caused a train to derail and the scattered cars were struck by an opposite direction freight train, killing 145 and injuring over 200 passengers.”<sup>12</sup> The United States

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<sup>9</sup> U.S. Department of Transportation, Federal Railroad Administration, “Amtrak Overview,” accessed January 2, 2015, <https://www.fra.dot.gov/Page/P0052/>.

<sup>10</sup> Amtrak, “National Fact Sheet FY 2013,” accessed May 12, 2015, <http://www.amtrak.com/ccurl/826/406/Amtrak-National-Fact-Sheet-FY2013-rev.pdf>.

<sup>11</sup> Amtrak, “Amtrak National Facts,” accessed January 2, 2015, <http://www.amtrak.com/servlet/ContentServer?c=Page&pagename=am%2FLayout&cid=1246041980246>.

<sup>12</sup> U.S. Government Accountability Office, GAO-13-20, *Passenger Rail Security, Consistent Incident Reporting and Analysis Needed to Achieve Program Objectives*

has been fortunate to have only one successful attack as mentioned earlier on our railroad system, which took place in 1995, near Palo Verde, Arizona. This intentional derailment of an Amtrak train happened near Palo Verde, Arizona killing one and injuring 78 others. The derailment sent two locomotives and eight cars off the tracks with four of those cars falling 30 feet off a bridge into a dry riverbed. The investigation found that the rails had been shifted out of position and the warning system was bypassed with wires that removed any chance of warning to the engineers.<sup>13</sup> Many other countries such as Russia, Japan, France, Azerbaijan, United Kingdom, China, and Italy have had their railroad system attacked by terrorists. Some of the methods include small to large explosives, suicide bombers, different types of incendiary devices and sabotage.

The results of this research will contribute to the efforts of the difficult task of finding solutions to protecting an open access system such as the United States railroad system. The results will help to identify vulnerabilities and offer suggestions that could provide necessary information for decision makers to implement the means needed to mitigate attacks. The ultimate goal from this research and previous research is to prevent terrorist attacks on the railroad system before they happen.

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(Washington, DC: U.S. Government Accountability Office, December 2012), accessed November 28, 2014, <http://gao.gov/assets/660/650995.pdf>.

<sup>13</sup> Doug McMurdo, "FBI Offers Large Reward for Tips on 1995 Train Crash," *Daily Miner*, April 24, 2015, accessed May 1, 2015, <http://kdminer.com/Main.asp?SectionID=1&SubSectionID=1&ArticleID=65695>.

## CHAPTER 2

### LITERATURE REVIEW

The purpose of this research is to answer the question: How vulnerable is the United States railroad system to terrorists attack? Many studies, research papers, and documents are attempting to address this subject of the vulnerability of the United States railroad system to terrorist attacks.

The majority of resources address the most common issues with general suggestions without detail, while others strive to give greater depth in a search for possible solutions. However, a compilation of this information could provide an operational design that melds the efforts, ideas, and innovations to identify and mitigate the vulnerabilities. This research will further focus on the areas of the railroad that are most susceptible to terrorist attacks, developing a more comprehensive and effective system of screening passengers and baggage, and the economic significance of the railroad system.

There is a large amount of information written on the need to protect the railroad system in the United States. Most research agrees that the railroad systems main vulnerability is that it is too immense to completely protect, which is why it is a tempting target to terrorists. The argument is that the 140,000 miles of track that is used nationwide and all of the entry points are simply too much to secure at one time. General acceptance of this view and a restriction in funds has led to a risk-based analysis method that determines priority for those funds and the level of protection that will be provided at the most vulnerable points. A comprehensive report; “Securing and Protecting America’s Rail Road System” prepared for Citizens for Rail Safety, concludes that, “The lack of

empirical data, drawn either from actual events or conclusive information regarding the goals and operations of terrorist groups, makes risk assessment and the allocation of resources to security measures difficult; nonetheless, a risk-based approach offers the best means of putting scarce resources into the most likely areas of terrorist activity.”<sup>14</sup> In a response to the Committee on Transportation and Infrastructure, Charles Jeszeck, Director, Homeland Security and Justice Issues, states the following. “Since it is neither practical nor feasible to protect all assets and systems against every possible terrorist threat, DHS has called for using risk-informed approaches to prioritize its security-related investments and for developing plans and allocating resources in a way that balances security and commerce. A risk-based management approach entails a continuous process of managing risk through a series of actions, including setting strategic goals and objectives, assessing risk, evaluating alternatives, selecting initiatives to undertake, and implementing and monitoring those initiatives.”<sup>15</sup>

The railroad system is comprised mainly of private companies, except for Amtrak, that operates almost entirely free of taxpayer support. Amtrak leases the same rails that are owned and operated by private freight railroad companies. “Freight railroads

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<sup>14</sup> Jeremy Plant and Richard Young, “Securing and Protecting America’s Railroad System: U.S. Railroad and Opportunities for Terrorist Threats” (A Report Prepared for Citizens For Rail Safety, Inc., The Pennsylvania State University, University Park, PA, June 2007), accessed November 17, 2014, <http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0CB8QFjAA&url=http%3A%2F%2Fwww.thebreaki ngnews.com%2Ffiles%2Farticles%2Ffrailpennstatestudy.pdf&ei=Z8tzVcmbEpLxoATsko Fw&usg=AFQjCNGiRhgUgqDYpSSokM0L7OZiZL8jfQ&sig2=LmhxSwpUjc114joOTx OW4w&bvm=bv.95039771,d.b2wl=>.

<sup>15</sup> U.S. Government Accountability Office, GAO-10-435R, *Intermodal Transportation Facilities* (Washington, DC: U.S. Government Accountability Office, May 27, 2010), accessed November 11, 2014, <http://www.gao.gov/products/GAO-10-435R>.

are overwhelmingly privately owned and operate almost exclusively on tracks the railroads companies build and maintain themselves. From 1980 to 2015, railroads spent approximately \$575 billion of their own funds on locomotives, freight cars, tracks, bridges, tunnels, and other infrastructure and equipment to keep the economy moving. In 2014, America's freight railroads budgeted \$28 billion to sustain and enhance the network on which America's economy rides."<sup>16</sup>

Literature supports that private rail industry responded quickly to and "cooperated fully with the government at all levels of the federal system since September 11, 2001 to develop an integrated system of intelligence sharing, and planning."<sup>17</sup> The companies worked hand-in-hand with the Federal Government to establish new security measures and to install new back-up systems for control and communications. However, how the federal government compiles, analyzes, reports, and shares the information seems to be under scrutiny. The TSA employs approximately 200-300 Surface Transportation Security inspectors. These inspectors are responsible to:

conduct inspections of freight rail operations throughout the nation. The efforts of the inspectors are focused on the areas of highest risk in the freight rail industry. The inspection program is responsible for verifying implementation of voluntary security measures, conducting vulnerability assessments, and conducting

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<sup>16</sup> Association of American Railroads, "Overview of America's Freight Railroads."

<sup>17</sup> Jeremy Plant, Richard Young, and Denise K. Krepp, "Protecting Critical Railroad Infrastructure" (A Report Prepared for Citizens for Rail Safety Inc., Pennsylvania State University, University Park, PA, March 2007), accessed November 22, 2014, [http://www.google.com/search?q=citizens+for+rail+safety%2C++protecting+critical+railroad+infrastructure%2C+plant%2C+young%2C+krepp&oe=utf-8&oq=&gs\\_l=](http://www.google.com/search?q=citizens+for+rail+safety%2C++protecting+critical+railroad+infrastructure%2C+plant%2C+young%2C+krepp&oe=utf-8&oq=&gs_l=).

regulatory compliance inspections. The inspectors also act as local liaisons to rail carriers and other government agencies for emergency planning and response.<sup>18</sup>

The Government Accountability Office (GAO) in a 2012 report expressed concerns with the Surface Transportation Security Inspectors program. The report found that the TSA had “inconsistently overseen and enforced its rail security incident reporting requirement.”<sup>19</sup> House Subcommittee on Transportation Security Chairman Rogers and CSX Vice President of Public Safety and Environment both were very critical of the program in a May 31, 2012 House Subcommittee on Transportation hearing.<sup>20</sup>

Although the federal government has taken many steps to improve the security of the railroad system, most of the research indicates a level of frustration from the railroad industry with the challenges that government oversight can create. There is a common theme that the oversight structure is too vast and somewhat confusing, caused by the numerous government agencies that have different levels of input and oversight.

The key federal government documents that lay the foundation and provide ways to protect our nation from terrorist attacks begin with the *United States Department of Homeland Security Strategic Plan 2012* that states the department’s vision as:

A homeland that is safe, secure, and resilient against terrorism and other hazards. The DHS mission is:

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<sup>18</sup> Transportation Security Administration, “Programs and Initiatives,” accessed January 16 2015, <http://www.tsa.gov/stakeholders/programs-and-initiatives>.

<sup>19</sup> Plant, Young, and Krepp, “Protecting Critical Railroad Infrastructure,” 6.

<sup>20</sup> U.S. Congress, House, Committee on Homeland Security, Subcommittee on Transportation, *Subcommittee Hearing: TSA’s Surface Inspection Program: Strengthening Security or Squandering Scant Resources?* May 31, 2012, accessed January 16, 2015, <http://homeland.house.gov/hearing/subcommittee-hearing-tsa%E2%80%99s-surface-inspection-program-strengthening-security-or-squandering>.

We will lead efforts to achieve a safe, secure, and resilient homeland. We will counter terrorism and enhance our security; secure and manage our borders; enforce and administer our immigration laws; protect cyber networks and critical infrastructure; and ensure resilience from disasters. We will accomplish these missions while providing essential support to national and economic security and maturing and strengthening both the Department of Homeland Security and the homeland security enterprise.<sup>21</sup>

The *Homeland Security Strategic Plan* has missions, goals, and objectives that provide a foundation and strategy for preventing terrorism in the United States. Next would be the *National Infrastructure Protection Plan 2013*. This document was called for by Homeland Security Presidential Directive 7, which establishes a national policy for Federal departments and agencies to identify and prioritize Critical Infrastructure and Key Resources, and to bring together the protection efforts from both the public and private sectors. It also meets the requirements of Presidential Policy Directive 21: Critical Infrastructure Security and Resilience, which advances a national unity of effort to strengthen and maintain secure, functioning, and resilient critical infrastructure.<sup>22</sup>

The *Transportation Systems Sector Specific Plan* describes collaboratively developed strategies to reduce risks to critical transportation infrastructure from the broad range of known and unknown terrorism threats. The *Transportation Systems Sector Specific Plan* adopts and amplifies the *National Infrastructure Protection Plan* risk management framework by describing a process intended to encourage wider participation in risk-reduction decision-making activities. The main objective of the

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<sup>21</sup> U.S. Department of Homeland Security, *Department of Homeland Security Strategic Plan, Fiscal Years 2012-2016*, February 13, 2012, accessed December 2, 2014, <http://www.dhs.gov/xlibrary/assets/dhs-strategic-plan-fy-2012-2016.pdf>.

<sup>22</sup> U.S. Department of Homeland Security, *National Infrastructure Protection Plan, 2013*, accessed October 27, 2014, <http://www.dhs.gov/national-infrastructure-protection-plan>.



process is to build a set of programs and initiatives that reduce the sector's most significant risks in an efficient, practical, and cost-effective manner.<sup>23</sup>

While the U.S. Department of Transportation (DOT) has authority to prescribe regulations for the safe transportation, including security, of hazardous materials in commerce, DHS has the lead authority and primary responsibility for security activities in all modes of transportation, including rail. DOT agencies, such as the Federal Railroad Administration and Pipelines and Hazardous Materials Safety Administration, are involved in promulgating and enforcing DOT safety and security regulations related to rail and hazardous materials. The Transportation Security Administration, however, is the lead federal entity for transportation security. The Aviation and Transportation Security Act of 2001 created the Transportation Security Administration. The Transportation Security Administration, originally located in the Department of Transportation, was supposed to be the one agency in the federal government responsible for the security of all modes of transportation. The Department of Homeland Security was created in 2002 and TSA moved to the new Department on March 1, 2003.<sup>24</sup>

“DHS and DOT have a Memorandum of Understanding (MOU) that addresses each agency's roles and responsibilities for rail transportation security, and both Departments work in close partnership to ensure that the highest safety and security standards are met.”<sup>25</sup> Still there is another but independent agency, the Surface Transportation Board, whose main responsibility is regulating the railroad industry. Yet, the House Subcommittee on Railroads, Pipeline and Hazardous Materials has jurisdiction

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<sup>23</sup> U.S. Department of Homeland Security, *Transportation Systems Sector-Specific Plan: An Annex to the National Infrastructure Protection Plan*, 2010, accessed October 30, 2014, <http://www.dhs.gov/xlibrary/assets/nipp-ssp-transportation-systems-2010.pdf>.

<sup>24</sup> Plant, Young, and Krepp, “Protecting Critical Railroad Infrastructure.”

<sup>25</sup> Deputy Secretary of Homeland Security and Deputy Secretary of Transportation, “Memorandum of Understanding Between the Department of Homeland Security and the Department of Transportation on Roles and Responsibilities,” National Transportation Library, October 2004, accessed November 11, 2014, [http://ntl.bts.gov/lib/48000/48100/48110/Memorandum\\_Of\\_Understanding\\_between\\_the\\_Department\\_of\\_Homeland\\_Security\\_and\\_the\\_Department\\_of\\_Transportation\\_on\\_Roles\\_and\\_Responsibilities.pdf](http://ntl.bts.gov/lib/48000/48100/48110/Memorandum_Of_Understanding_between_the_Department_of_Homeland_Security_and_the_Department_of_Transportation_on_Roles_and_Responsibilities.pdf).

over any issues that are in the purview of the Safety Transportation Board, Federal Railroad Administration (FRA), and Amtrak. In addition, transportation security funding can be supplied at all government levels by the DHS through federal funding programs based on risk and threat assessment and grant programs which are obtained through application for the funds.

In April of 2015, DHS announced guidance for nine preparedness grants and the amount of funds that would be available for each from a total of \$1.6 billion. The grant programs provide funding to state, local, tribal and territorial governments, as well as transportation authorities, nonprofit organizations, and the private sector, to improve the nation's readiness in preventing, protecting against, responding to, recovering from, and mitigating terrorist attacks, major disasters and other emergencies. Of the total amount, Amtrak would receive \$10 million from the dedicated Intercity Passenger-Amtrak Program. The freight rail industry would be eligible for funds through the Transit Security Grant Program.<sup>26</sup> The railroad system appeared to get an influx of funding through the American Recovery and Reinvestment Act of 2009. However, the administration's priority placed on developing High Speed Railway (HSR) was attached

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<sup>26</sup> U.S. Department of Homeland Security, Press Office, "DHS Announces Grant Guidance for Fiscal Year 2015 Preparedness Grants," April 2, 2015, accessed May 15, 2015, <http://www.dhs.gov/news/2015/04/02/dhs-announces-grant-guidance-fiscal-year-fy-2015-preparedness-grants>.

to those funds, approximately \$11 billion,<sup>27</sup> and by 2014 with no real progress shown, Congress requested an additional \$10 billion for HSR initiatives.<sup>28</sup>

With all of the above listed agencies, documents, and regulations, funding and grants, there was confusion on whether the agencies and information was being processed and shared correctly. This was addressed in the 2010 *Surface Transportation Security Priority Assessment* released by the federal government. The assessments purpose was as to reach out “across the spectrum of government and private sector stakeholders in surface transportation security. The study identified a set of 10 issue areas to examine, obtained input from surface transportation sector stakeholders, and analyzed the responses to reach a consensus set of priorities and recommendations.”<sup>29</sup> The *Surface Transportation Security Priority Assessment* also gave 20 recommendations that were intended, if implemented, would address most concerns that opponents have to the current state. This assessment did help in many areas but as can be seen above with the funds allocated to HSR, and little results to show, there is still a collaboration problem. This is concerning and raises the issue, are the right questions being asked to identify the vulnerabilities and threats to the railroad industry. Is the information being shared and are

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<sup>27</sup> U.S. Department of Transportation, Federal Railroad Administration, “High Speed Rail Overview,” accessed May 8, 2015, <https://www.fra.dot.gov/Page/P0060>.

<sup>28</sup> Ron Nixon, “\$11 Billion Later, High-Speed Rail is Inching Along,” *New York Times*, August 6, 2014, accessed May 8, 2015, [www.nytimes.com/2014/08/07/us/delays-persist-for-us-high-speed-rail.html?\\_r=0](http://www.nytimes.com/2014/08/07/us/delays-persist-for-us-high-speed-rail.html?_r=0).

<sup>29</sup> U.S. Department of Homeland Security and U.S. Department of Transportation, *Surface Transportation Security Priority Assessment* (The White House, March 2010), accessed November 23, 2014, [http://www.whitehouse.gov/sites/default/files/rss\\_viewer/STSA.pdf](http://www.whitehouse.gov/sites/default/files/rss_viewer/STSA.pdf).

the funds being applied correctly that would result in the application of the appropriate measures to deter and mitigate terrorist attacks on the railroad system.

Information sharing and funding are not the only issues and unfortunately are replaced in the headlines with such incidents as those involving the derailment of trains. Recently one incident resulted in injuries and 47 deaths in Canada, and two others, one in 2014 in Lynchburg, Virginia and another in 2013 in Huron, South Dakota, that have heightened the already present concern of the vulnerability of tank cars that carry dangerous chemicals or flammable liquids. This growing emotional issue has several different facets, which were equally referenced in research and all have the potential to develop in the public eye. The Virginia derailment was the latest Bomb Train incident, a growing common reference used predominantly by those opposed to the transportation of crude oil in tank cars. The reference comes from trains carrying tank cars full of oil that could derail and explode.

The first facet is the concern that comes from those living in the towns through which the train's transit, transporting tank cars full of oil or dangerous chemicals. Some of those citizens are accusing the government of moving the dangerous cargo in secret. The citizens want to know the schedule of the trains and what dangerous products they are transporting so they and the towns emergency responders can be prepared in case of an incident. "After the attacks of 9/11, the government sealed off huge categories of

right-to-know records, for fear they would become a road map for terrorists. Citizens who want to be informed about local hazards were collateral damage.”<sup>30</sup>

This raises the second facet of privacy rights versus the need to mitigate the chance of terrorist attacks on the railroad system. There are several ways to intentionally inflict catastrophic damage using multiple tank cars loaded with fuel. One of these would include derailing the train as it comes within close proximity of a town by using some type of explosive device activated by a suicide bomber or with a timing device. Releasing the requested schedule information has some positive points in the protection of the citizens and, in the case of accidental derailment, has negative points in using the information to cause harm to possibly those same citizens. Within a week of the Virginia derailment, the DOT announced under emergency order the following statement.

By this Order, DOT is requiring that each railroad carrier provide the State Emergency Response Commission (SERC) for each state in which it operates trains transporting 1,000,000 gallons or more of Bakken crude oil, notification regarding the expected movement of such trains through the counties in the state. The notification shall identify each county or a particular state or commonwealth’s equivalent jurisdiction (e.g., Louisiana parishes, Alaska boroughs, Virginia independent cities) (county), in the state through which the trains will operate.<sup>31</sup>

However, this order is very limited since it restricts the notification to only trains carrying over one million gallons of Bakken crude oil.

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<sup>30</sup> James Shiffer, “Full Disclosure: What’s in those Rail Cars?” *StarTribune*, May 3, 2014, accessed December 12, 2014, <http://www.starttribune.com/local/stpaul/257810281.html>.

<sup>31</sup> U.S. Department of Transportation, “Emergency Restriction Prohibition Order,” February 23, 2014, accessed December 12, 2014, <http://www.dot.gov/briefing-room/emergency-order>.

The primary target globally for attacks on the railroad system is the station entry point where passengers mass and provide the biggest opportunity for devastating effects. The general view seems to be that railroad systems are open with multiple points of entry, and screening all passengers would cause crippling operational delays. Research shows the common opinion is that methods used to screen passengers in the aviation environment were not possible in the railroad environment until recently. In London, fresh consideration is to be given to the introduction of airport-style mass security screening at mainline rail stations and across London's tube network.<sup>32</sup> In Pakistan, which had 18 attacks in 2013 on their national railroad "Pakistan Railroads," began checking baggage and cargo at every railway station for explosives.<sup>33</sup> Another report, "Securing America's Passenger Rails," suggest that large cities like New York and Boston that have transfer points that link to long-distance rail service, should consider following the Madrid model of establishing a passenger-only area for screening and boarding Amtrak long-distance service.<sup>34</sup>

Behavioral profiling is another method of screening that has been declared successful for many years in Israel at the Ben Gurion airport and is being tested in the

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<sup>32</sup> Alan Travis, "Airport-style Screening to be Considered for Train and Tube Stations," *The Guardian*, August 2012, accessed November 12, 2014, <http://www.theguardian.com/uk/2012/aug/19/train-tube-stations-security-screening>.

<sup>33</sup> Rehman Yasir, "Pakistan Boosts Railway Protection," Central Asia Online, February 2014, accessed October 29, 2014, [http://centralasiaonline.com/en\\_GB/articles/caii/features/pakistan/main/2014/02/28/feature-01](http://centralasiaonline.com/en_GB/articles/caii/features/pakistan/main/2014/02/28/feature-01).

<sup>34</sup> Nicholas Armstrong, Bland Drew, Cox Edward, Oddo Eric, Wears Dan, and P. C. Zai, *Securing America's Passenger Rails: Analyzing Current Challenges and Future Solutions* (Syracuse, NY: Maxwell School of Citizenship and Public Affairs, Syracuse University, June 4 2008), accessed November 28, 2014, <http://insct.syr.edu/wp-content/uploads/2013/02/Securing-Americas-Passenger-Rails.pdf>.

Netherlands at the Amsterdam Airport Schiphol. Behavioral profiling or behavior pattern recognition is a method to recognize terrorist by a process of observing their mannerisms either by direct or indirect contact. In 2007, the United States TSA began this screening program known as Screening of Passengers by Observation Techniques (SPOT). This program is operating at approximately 180 airports by 3,000 behavior detection officers. These officers are trained to look for close to a 100 different signs through observation or questions that may indicate fear, stress, or deception. If they feel that anyone has displayed enough of these indicators, they may then be referred for a pat down and secondary screening.<sup>35</sup> Initially when the United States Customs agents were trained on this program, their “hit rate” for finding drugs during passenger searches rose from 4.2 percent to 22.5 percent in 1998.<sup>36</sup> Since 2007, the United States has appropriated \$200 million a year for this program and has received considerable resistance and questioning of its success rate. The GAO study reports that the observations can be subjective and other scientific literature suggest, “The ability of human observers to accurately identify deceptive behavior based on behavioral cues or indicators is the same as or slightly better than chance (54 percent).”<sup>37</sup> However what about the country of Israel, which uses behavior detection as an integral part of their security program, which has not experienced a serious terrorist incident at the Ben Gurion Airport in more than 30 years.

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<sup>35</sup> Nate Anderson, “TSA’s Go 94 Signs to ID Terrorists, but They’re Unproven by Science, Government Auditor Slams \$900M Spent on Unproven Program,” ARS Technica, November 13, 2013, accessed October 8, 2014, <http://arstechnica.com/tech-policy/2013/11/despite-lack-of-science-tsa-spent-millions-on-behavioral-detection-officers>.

<sup>36</sup> Ibid.

<sup>37</sup> Ibid.

No airport in the world faces terrorist threats more serious than does Ben Gurion Airport in Tel Aviv, Israel, a focal point for a half-century of violence in the Middle East. A director of security at the Ben Gurion airport states, “Of course, looking for weapons is important. But then again, the Sept. 11 terrorists didn’t use weapons—they used box cutters. You must look at the problem of security from 360 degrees and develop procedures that go beyond looking for weapons. Technology is not a comprehensive tool and it can only do one thing: detect weapons. If you do not develop security procedures that go beyond technology, you are doomed to lose at the end of the day.”<sup>38</sup>

Research shows that not all reports are as positive as from the security forces that utilize these methods. The DOD reports in its own study, “there is scant proof that the Screening of Passengers by Observation Techniques (SPOT) program works to deter terrorism. The Government Accountability Office recommended cutting off funding for the program, which has totaled nearly \$900 million since 2007.”<sup>39</sup>

Since the aviation industry is the high watermark for success in transportation security since 9/11, the railroad industry is attempting to catch up in the area of security and prevention. Despite some negative feedback and having to deal with the issues of civil rights, efficiency, and rapidity of embarking and debarking, Amtrak has incorporated the Screening of Passengers with Observation Techniques program along with others programs that provide visible and unpredictable deterrents. Amtrak Chief of Police, John O’Connor, reports some of the other methods being utilized are hardening the physical infrastructure by increasing the number of video cameras, amount of fencing,

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<sup>38</sup> SecuritySolutions, “What Can We Learn from Ben Gurion Airport in Israel to Help Push Aviation Security in the U.S. to the Next Level?” accessed December 1, 2014, [http://securitysolutions.com/news/security\\_exposing\\_hostile\\_intent](http://securitysolutions.com/news/security_exposing_hostile_intent).

<sup>39</sup> Ashley Halsey III, “House Member Questions \$900 Million TSA ‘SPOT’ Screening Program,” *Washington Post*, November 14, 2013, accessed December 15, 2014, [http://www.washingtonpost.com/local/trafficandcommuting/house-member-questions-900-million-tsa-spot-screening-program/2013/11/14ad194cfe-4d5c-11e3-be6b-d3d28122e6d4\\_story.html](http://www.washingtonpost.com/local/trafficandcommuting/house-member-questions-900-million-tsa-spot-screening-program/2013/11/14ad194cfe-4d5c-11e3-be6b-d3d28122e6d4_story.html).



and a collaborative effort with a TSA program called Visible Intermodal Protection and Response (VIPR). This program is “an unannounced surge of uniformed officers on trains and at stations to deter and detect suspicious behavior.”<sup>40</sup> An integral part of the Visible Intermodal Protection and Response program are the highly trained canines that serve to detect explosives and contribute to the visible deterrent, particularly for passenger screening. Chief O’Connor explains, “Amtrak has more than doubled the size of its Explosive Canine Detection Program that includes several that have ‘vapor wake’ training, where the dogs can detect the presence of fumes left after someone passes through an area with an explosive device.”<sup>41</sup> Some argue that stopping the attacks before they happen is exactly what these deterrent methods are accomplishing. Literature seems to argue both sides on whether techniques such as the visible questioning of passengers, explosive sniffing canine, and an unannounced influx of officers into a station for random checks, are enough of a deterrent to stop attacks.

One constant in this literature review is the agreement that the United States freight railroad system provides tremendous benefits for the economy and the country. The United States freight rail network consists of 140,000 miles of track, which are operated and maintained by more than 570 freight railroads. The largest are the seven Class I railroads that account for 90 percent of employees and 94 percent of revenue. A Class I railroad is defined as having annual operating revenues of \$250 million or more

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<sup>40</sup> Amtrak, “Amtrak News Release, Amtrak Security Efforts Aim to Defeat and Deter Most Dangerous and likely Terror Tactics,” April 21, 2010, accessed November 22, 2014, [http://www.amtrak.com/ccurl/7/679/ATK-10-51%20Amtrak%20Security%20Efforts%20Aim%20to%20Defeat%20and%20Deter%20\(04-21-10\).pdf](http://www.amtrak.com/ccurl/7/679/ATK-10-51%20Amtrak%20Security%20Efforts%20Aim%20to%20Defeat%20and%20Deter%20(04-21-10).pdf).

<sup>41</sup> Ibid.

after adjusting for inflation using the Railroad Freight Price Index developed by the Bureau of Labor Statistics. The AAR reports that Class I railroads had a minimum carrier operating revenue of \$433 million or more in 2011. The remainders are Non-Class I railroads, also known as regional and short line railroads. The 21 Regional railroads are classified as those that operate at least 350 miles of rail or make at least \$40 million per year. The approximately 540 local non-regional or short-line railroads are classified as those that have annual operating revenues of less than \$20 million.<sup>42</sup> “Together with their counterparts in Canada and Mexico, North America’s freight railroads form the world’s most efficient, cost effective, and reliable freight rail system in the world.”<sup>43</sup> The freight railroad industry provides more than 185,000 jobs and another additional one million jobs is attributed to the companies that provide services and goods or are recipients of spending by the employees of railroads and their suppliers.<sup>44</sup>

The American Association of Railroads (AAR) and the DOD are two reputable sources that provide similar statistics about the benefits of this private industry. These statistics would include: (1) the investment of over \$575 billion since 1980 to improve the equipment and infrastructure; (2) Easing taxpayer burdens by operating on an infrastructure that is funded almost entirely by the privately owned railroads. An infrastructure they built, own, maintain and pay for themselves, unlike the other modes of

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<sup>42</sup> Association of American Railroads, “Overview of America’s Freight Railroads.”

<sup>43</sup> Association of American Railroads, “Economic and Public Benefits,” accessed December 15, 2014, <https://www.aar.org/todays-railroads/our-network>.

<sup>44</sup> Association of American Railroads, “Overview of America’s Freight Railroads.”

transportation such as trucks, barges, and airlines, that is funded mainly by taxpayers;

(3) Trains have a combined effort of four times the fuel efficiency of a truck, 75 percent less greenhouse gas emission, and help reduce highway congestion. One other example is that one average freight train that has approximately 125 cars, can move the freight of several hundred trucks which in turn would reduce the degradation and need for frequent maintenance of highways, and possibly defer building new highways.<sup>45</sup>

The available literature on terrorism and the vulnerability of the transportation sector is immense and is structured around the premise that the railroad system is too vast to protect it all. Most all of the literature begins with the “too large and too costly to protect” mindset and builds risk management suggestions and solutions from that point. There seems to be agreement on the economic benefits and value of the railroad, and a growing sense of urgency to harden the methods of protection. However, protection of the railroad system still seems to have a long way to go before it becomes an equal partner with the aviation system in the eyes of the public and decision makers.

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<sup>45</sup> American Association of Railroads, “The Economic Impact of American’s Freight Railroads.”

## CHAPTER 3

### RESEARCH METHODOLOGY

The purpose of this research is to answer the question: How vulnerable is the United States rail system to terrorist attack? This chapter is organized by an overview of the research material gathered, explanation of the evaluation data, and the significance.

The collection of data came from a compilation of prior research, Legislative Acts, and publications. Numerous resources concentrate on a few of the elements necessary to protect the railroad system. There are also comprehensive reports that are wider in research and delve into topics beyond the intended scope of this paper. Most of these documents succeed in identifying the areas that are vulnerable to attack, detect weaknesses in the system, and recognize the difficulty of preventing an attack, and offer valid solutions to some of the issues. However, all acknowledge the gaps in security, the dangerous possibilities, and continue to call for a more concentrated effort.

Tables 1 to 4 will each depict different areas of comparison of the United States to five other countries; Russia, China, France, Canada, and India and are shown with categories but without data. Tables 9 to 12 will be the same tables with the data populated.

Table 1 was created to compare the United States railroad system with five other countries' railroad systems. The following 10 criteria questions were researched as they apply to the United States. The same 10 criteria questions were then applied to the five other country's railroad systems to draw a comparison between the six countries.

1. Form of government
2. How many miles of railroad are there in the country?

3. Data depicting the total number of locomotives of passenger and freight, freight cars, and passenger cars.
4. Data depicts the annual passengers per year.
5. Is the private railroad system government or privately owned?
6. Is the freight railroad system government or privately owned?
7. Does the passenger railroad system have a dedicated protection force?
8. Does the freight railroad system have a dedicated protection force?
9. Are the railroad systems an economic benefit to the country?
10. Would a major disruption in service of the freight or passenger railroad systems have a negative impact on the country's economy?

Table 1. Criteria Comparison Chart

Areas of Study ↓	United States	Russia	China	France	Canada	India
Form of Government						
Rail Miles						
Annual Passengers						
Locomotives Freight Cars Passenger Cars						
Passenger Rail Private or Government Owned						
Freight Rail Private or Government Owned						
Passenger Railroad Protection Force						
Freight Protection Force						
Railroad System Economic Benefit						
Would Disruption Affect Economy						

*Source:* Created by author.

Table 2 will reflect the number of terrorist attacks on each country's railroad system from 2008-2014. Table 3 will reflect the Global Terrorist Index (GTI) rankings

for the six selected countries for 2012 and 2014. Table 4 will reflect the GTI rankings for the top five countries with the highest incidents and most affected by terrorist attacks.

Table 2. Number of Attacks on Railroad System by Country

Country 2008-2014	# Of Attacks	Injuries	Deaths
United States			
India			
Russia			
China			
Canada			
France			

*Source:* Created by author.

Table 3 reflects the rankings of the six countries in this paper's study. The rankings are based on GTI's ranking of 162 countries:

#### GTI Scoring System

The GTI score for a country in a given year is based on a unique scoring system to account for the relative impact of incidents in the year. There are four factors counted in each country's yearly score:

Total number of terrorist incidents in a given year.

Total number of fatalities caused by terrorism in a given year.

Total number of injuries caused by terrorism in a given year.

The approximate level of total property damage from terrorist incidents in a given year.

Each of the factors is weighted differently and a five year weighted average is applied to reflect the lingering psychological effect of terrorist acts over time.<sup>46</sup>

Table 3. GTI Ranking

Country	Ranking 2012	Ranking 2014
United States		
India		
Russia		
China		
France		
Canada		

*Source:* Created by author.

Table 4 will reflect the top five countries with the highest incidents and most affected by terrorist attacks.

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<sup>46</sup> Institute for Economics and Peace, “Global Terrorism Index 2014: Measuring and Understanding the Impact of Terrorism,” Vision of Humanity, 2014, accessed April 5, 2015, [http://www.visionofhumanity.org/sites/default/files/Global%20Terrorism%20Index%20Report%202014\\_0.pdf](http://www.visionofhumanity.org/sites/default/files/Global%20Terrorism%20Index%20Report%202014_0.pdf).



Table 4. Top Five Countries by Incidents and Terrorist Attacks

Top 5 Countries	Ranking 2014

*Source:* Created by author.

## CHAPTER 4

### ANALYSIS

For those determined to kill in quantity and willing to kill indiscriminately, public transportation offers an ideal target.

—Brian Jenkins, “Protecting Public Surface Transportation Against Terrorism and Crime: An Executive Overview”

Is the United States railroad system vulnerable to terrorist attacks? This document has established that railroad systems, whether they are in the United States or global, are attractive targets and vulnerable to terrorist attacks. The coordinated bombing of the commuter trains in Madrid, Spain in 2004 that killed 191 and injured approximately 1,800 showed just how vulnerable the railroad system was in Spain.<sup>47</sup> Some media outlets secured a copy of a DHS/Federal Bureau of Investigation (FBI) intelligence bulleting specifying information taken from the raid on Osama Bin Laden’s compound in 2011 indicating a plan to derail a United States train on the tenth anniversary of 9/11.<sup>48</sup> Another plot was revealed through FBI documents involving several Canadian men in 2013, who were receiving direction from the successor to Osama Bin Laden’s terrorist organization Al Qaeda.<sup>49</sup> They were charged with plotting to derail a Canadian Via passenger train between New York City and Toronto. The United States has learned from

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<sup>47</sup> Global Security, “Strategic Rail Corridor Network (STRACNET),” accessed March 30, 2015, <http://www.globalsecurity.org/military/facility/stracnet.htm>.

<sup>48</sup> Jeanne Meserve and Carol Cratty, “U.S.: Al Qaeda has Interest in Strikes on Energy Infrastructure,” *CNN*, May 20, 2011, accessed June 7, 2015, <http://www.cnn.com/2011/US/05/20/terror.alert>.

<sup>49</sup> Chelsea J. Carter, “Congressman: Thwarted Terror Plot Targeted Train from Canada to U.S.” *CNN*, April 22, 2013, accessed December 1, 2014, [www.cnn.com/2013/04/22/world/americas/canada-terror-plot-thwarted/](http://www.cnn.com/2013/04/22/world/americas/canada-terror-plot-thwarted/).

the 9/11 attacks and is now striving to deter attacks on the railroad system. A 2012 study shows worldwide over a 30 year period, 1982-2011, “terrorist attacks show a long-term trend away from air attacks and toward railroad and subway attacks, underscoring the need for increased intelligence gathering to intercept those redirected attempts. Successful terrorists have shifted their focus in recent years away from attacking airlines to attacking subway and rail systems.”<sup>50</sup> The question remains, are the efforts being placed in the right areas and are they enough?

#### Amtrak-Passenger

In the United States, Amtrak and its police department is the main effort to deter, mitigate, and prevent terrorist attacks on our passenger trains. Is this line of defense enough, and are they structured in a way that can withstand the methods of today’s terrorists?

To date, the different types of attacks that have occurred on United States trains, and must be considered in risk analysis are knife attacks and shootings. Knife attacks on trains are rare and would probably be due to some type of one-on-one personal conflict or robbery. A knife attack as a method of terrorism would seem unlikely, but occurred several times in other countries. The worst incident happened at a train station in China:

where five knife-wielding assailants hacked 31 people to death and injured 141 on March 1, 2014. Four of the assailants were shot dead at the scene and the fifth, a pregnant woman, was captured alive and later sentenced to life in prison on the charges of joining a terror group and murder. Three men convicted of masterminding the attacks were executed in March of 2015. A motive was

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<sup>50</sup> Arnold Barnett, “Terrorist Attacks have Shifted from Air to Rail,” *Science Daily*, February 27, 2015, accessed May 14, 2015, <http://www.sciencedaily.com/releases/2015/02/150227112502.htm>.

undetermined but many theories were pushed forward ranging from ethnic issues to the heavy handed rule (sic) of the Chinese government.<sup>51</sup>

The rare occurrence of a knife attack happened in the United States in December of 2014 on an Amtrak train traveling from Chicago to Port Huron, Michigan. Amtrak Chicago officials notified the Niles Police Department, advising they had a man acting strangely and agitated. When the train stopped near Niles, Michigan, the officers entered the train, found that the subject had already stabbed four individuals unknown to him, and then threatened the officers with the knife. He was subdued with a stun gun, removed from the train, and placed into custody. He was later charged with four counts of attempted murder and the motive for this attack has yet to be determined.<sup>52</sup> It is interesting to highlight two points; first, the local police were required to respond to this incident, and no Amtrak police officers were on the train or involved in the apprehension of the suspect that originated from the Chicago area. Second, although knives are specifically prohibited on Amtrak trains, the suspect was obviously not selected in the random screenings, which is the only method of weapon detection utilized by the Amtrak Police Department (APD).

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<sup>51</sup> ABC News, "China Executes 3 Over Kunming Knife Attack That Killed 31," March 25, 2015, accessed March 29, 2015, <http://abcnews.go.com/International/wireStory/china-executes-knife-attack-kunming-train-station-29859892>.

<sup>52</sup> NBC News, "Amtrak Stabbing: Man Charged With Intent to Murder After Attacking 4," December 6, 2014, accessed March 4, 2015, <http://www.nbcnews.com/news/crime-courts/amtrak-stabbing-man-charged-intent-murder-after-attacking-4-n262891>.

In 2013, an FBI study addressed the issue of an active shooter, focusing on the location of the attacks. In the 160 active shooter cases examined between 2000 and 2013, none involved an active shooter involving the railroad system.<sup>53</sup>

The DHS describes the profile of an Active Shooter:

An Active Shooter is an individual actively engaged in killing or attempting to kill people in a confined and populated area; in most cases, active shooters use firearms(s) and there is no pattern or method to their selection of victims.

Active shooter situations are unpredictable and evolve quickly. Typically, the immediate deployment of law enforcement is required to stop the shooting and mitigate harm to victims.

Because active shooter situations are often over within 10 to 15 minutes, before law enforcement arrives on the scene, individuals must be prepared both mentally and physically to deal with an active shooter situation.<sup>54</sup>

Although encouraging for passenger rail, this statistic should not lower the guard of the APD from being prepared for this type of situation. However, one does not have to look back far in history to find an Active Shooter train incident. In December of 1993 in New York, there was an active shooter:

onboard the Long Island Rail Road commuter train that resulted in the killing of six people and injuring nineteen others. The gunman waited for the train doors to close and as the train was moving, walked down the aisle shooting until his gun was empty, reloading two different times, and continuing to shoot until twenty-

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<sup>53</sup> U.S. Department of Justice, Federal Bureau of Investigation, “A Study of Active Shooter Incidents in the United States between 2000 and 2013,” September 16, 2013, accessed February 22, 2015, <http://www.fbi.gov/news/stories/2014/september/fbi-releases-study-on-active-shooter-incidents/pdfs/a-study-of-active-shooter-incidents-in-the-u.s.-between-2000-and-2013>.

<sup>54</sup> U.S. Department of Homeland Security, *Active Shooter: How to Respond*, accessed March 29, 2015, [http://www.dhs.gov/xlibrary/assets/active\\_shooter\\_booklet.pdf](http://www.dhs.gov/xlibrary/assets/active_shooter_booklet.pdf).

five people were either dead or injured. He was eventually tackled by passengers while attempting to reload for the third time.<sup>55</sup>

Surprisingly the time needed for him to accomplish this was less than three minutes. The incident now known as the Long Island Railroad Massacre did not happen on an Amtrak train. This incident does provide a clear example of one of the major vulnerabilities of passenger rail and the possibilities of what could happen. The gunman was found guilty and was sentenced to 200 years in prison.<sup>56</sup>

Another incident that did happen on an Amtrak train in December of 2011 was during a stop at Union Station in Dallas, Texas:

Three plainclothes Dallas narcotics officers and a drug canine were at Union Station to search for suspicious activity. They noticed a couple acting in a suspicious manner in the Union Station Lobby and followed them onboard the train. The officers approached the pair and identified themselves as police. The officers asked the woman if they could search her belongings and she agreed. The man refused to consent to a search. According to police, the man then jumped up from his seat, pulled a gun from his waistband, and pointed it inches from the face of one of the officers. "Gun, gun, gun!" one of the officers yelled as he drew his weapon and began firing. Two other officers also fired at the suspect in the passenger compartment. The suspect was killed and one officer and one passenger were wounded.

It was later determined that all three officers fired their weapons and the suspects gun was never fired, leading to the conclusion that the shots that wounded the other officer and passenger came from friendly fire. There also were no drugs found on either of the suspects, but the male suspect had convictions for larceny, fraud, and theft.<sup>57</sup>

The officers did an excellent job identifying someone that proved to be breaking the law and was putting lives at risk by carrying a loaded weapon onboard the train.

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<sup>55</sup> About.com, "Colin Ferguson," About News, accessed March 29, 2015, <http://crime.about.com/od/murder/p/frguson.htm>.

<sup>56</sup> Ibid.

<sup>57</sup> Ibid.

There are two vulnerabilities exposed in this incident that are part of the overall larger vulnerability of passenger railroad, which will be discussed in more detail later in this chapter. First, is the ease of being able to get a loaded gun onboard the train, and second, is the decision to allow the suspects onboard the train before they were confronted.

Dallas Police Chief David Brown said, “Security screening would have prevented somebody from getting on a train” with a weapon. He also stated, “He did not think it would have been safer to confront the suspects in the terminal instead of waiting until he boarded the train, officers did not needlessly put people in danger.”<sup>58</sup> Federal authorities at the same time stated the common statement this paper has found when the issue of mandatory screening of passengers and baggage is questioned. “The openness of the rail system makes mandatory screenings of passengers and baggage impractical.”<sup>59</sup>

The APD has already been delivering Active Shooter training and continues to do so. The training gives direction for responding officers to assess and perform rapid intervention tactics in order to limit serious injury or loss of life. There is also similar training for employees and Amtrak released a video in 2013 called “Take Flight, Take Cover, Take Action”<sup>60</sup> for the safety of passengers and non-passengers in an Amtrak station. This video gives a very clear message of how individuals should protect

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<sup>58</sup> Dallas Country, “Amtrak Shooting at Dallas’ Union Station Highlights Rail Security Gaps,” December 7, 2011, accessed March 29, 2015, <http://www.dallasnews.com/news/community-news/dallas/headlines/20111206-amtrak-shooting-at-dallas-union-station-highlights-rail-security-gaps.ece>.

<sup>59</sup> Ibid.

<sup>60</sup> Amtrak, “Take Flight, Take Cover, Take Action,” You Tube, November 6, 2013, accessed February 28, 2015, <https://www.youtube.com/watch?v=wot2FwYCKm8>.

themselves during an active shooter incident. It is presented in a way that the common person can understand, remember, and could be their best chance of survival. This personal safety video could actually be applied to almost any scenario involving an attack and this author would encourage Amtrak to promote this video again for those who have no training or have never thought this through. One other suggestion about the video may also be in order. There are three situations played out in the video, however all three are set only in an Amtrak station. As effective as this video is, a second or revised video that includes those same examples played out on a moving train would be extremely helpful in saving passenger lives.

Some interesting facts from the FBI Active Shooter study show that 41 percent of the incidents ended in shooter suicide and 13 percent ended when unarmed citizens made the selfless and deeply personal choice to face the danger of an active shooter. Other categories listed interventions involving armed citizens that had valid firearm permits or off-duty law enforcement personnel. These actions surely saved the lives of others present.<sup>61</sup>

These incidents are tragic and terrifying on any scale and bring into the discussion the risk-based analysis and management methodology and attempts to answer the question on where to place the resources that best mitigate the possibility of terrorist attack. This risk-based methodology is used by the United States Government to assess the vulnerabilities of Critical Infrastructure that includes the railroad system. There is little question that this methodology is required due to limited resources and at this time

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<sup>61</sup> Department of Justice, Federal Bureau of Investigation, *A Study of Active Shooter Incidents in the United States between 2000 and 2013*.



the most effective method available. We accept the skill level of those performing the evaluations and producing the results of the prioritization of resources. However, this system and the protection it is offering is mitigated when coupled with the accepted overarching belief that the railroad system is too vast to protect and that the risk outweighs the disadvantages of inconvenience and delays produced by aviation type screening that would prevent such incidents as described above.

Without question, the worst-case scenario would certainly be one of mass casualties and this author believes it could occur in any of three ways. The first would be an explosive placed in a crowded train station where passengers mass waiting to board a train. As stated earlier, globally it is reported that using some type of bomb is the leading method of terrorist attack and accounts for approximately 75 percent of attacks on passenger trains.

Table 5. Amtrak's Five Busiest Stations Based on Annual Passengers

Station	Number of Annual Passengers
New York Penn Station	10 Million
Washington, DC Union Station	5 Million
Philadelphia 30th St Station	4.2 Million
Chicago Union Station	3.5 Million
Los Angeles Union Station	1.8 Million

*Source:* Created by author using information from Amtrak, "Amtrak National Facts," accessed January 2, 2015, <http://www.amtrak.com/servlet/ContentServer?c=Page&pagename=am%2FLayout&cid=1246041980246>.

These large stations or even a smaller station such as Kansas City, Missouri Union Station which sees approximately 160,000 riders per year, each have their own attraction to terrorists.<sup>62</sup> Where the payoff in casualties may be higher in a busier station, so also may be the risk of being caught and not completing their attack. On the other hand, a smaller station could be seen as a target that has fewer resources for protection, less risk of detection and intervention, and a higher probability of a successful attack even though the causality count would be less. This is a good example of the utilization of the risk-based analysis and management methodology. A general definition of Risk Management is the “identification, assessment, and prioritization of risks followed by coordinated and economical application of resources to minimize, monitor, and control the probability and/or impact of an undesired event.”<sup>63</sup> That definition applied to the potential for terrorist attack on a railroad station would surmise that in a funding restricted environment, the smaller stations with less potential for attack and mass casualties will receive fewer resources for protection. What must be determined through this methodology and made available to the public is the protective measures implemented through this analysis method is the acceptance of prudent risk and not gambling on the safety of passengers.

There are several areas to consider in the protection of passengers and non-passengers. The non-passengers in this case could be passenger relatives dropping them off or picking them up or railroad employees. This paper will not separate the different

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<sup>62</sup> Amtrak, “Amtrak National Facts.”

<sup>63</sup> Douglas Hubbard, *The Failure of Risk Management: Why It's Broken and How to Fix It* (Hoboken, NJ: John Wiley and Sons, 2009), 46.

methods of protection for the two groups and will address them as one, with the exception of listing areas that have access limitations to employees only.

The main defense mechanism for protection of the passenger trains in the United States is the APD. The APD was established along with Amtrak's enabling legislation, the Rail Passenger Service Act of 1970 that is found at 49 U.S.C. 24101.<sup>64</sup> This legislation established the authority for Amtrak to have its own police force. APD Officers have the same police authority as a local or state law enforcement officer within their jurisdiction. The officers are authorized by Federal Statute to enforce laws and conduct investigations nationwide, related to crime occurring on Amtrak property. The APD is a national police force committed to protecting the passengers, employees, and stakeholders of Amtrak. More than 500 sworn and civilian personnel at more than 30 locations in 46 states conduct a range of behind-the-scenes and front line security measures to ensure Amtrak employee, passenger, and infrastructure safety and security.<sup>65</sup>

Very interesting is the fact stated above that there are 500 Amtrak Police officers stationed at 30 locations in 46 states, which insure all of the security measures necessary for Amtrak. This is interesting because there are approximately 500 Amtrak destinations and only 30 locations have Amtrak officers securing the facilities. The APD states that they work in a collaborative effort with local, state, and federal law enforcement such as the TSA, FBI, and DHS to share best practices and other vital information. These

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<sup>64</sup> Amtrak Police Department, "A Brief History of the Amtrak Police Department," accessed February 7, 2015, <https://police.amtrak.com/index.php/about/apd-history>.

<sup>65</sup> Amtrak Police Department, "From the Chief," accessed February 7, 2015, <http://police.amtrak.com/index.php/from-the-chief>.

different agencies are able to respond when requested and supplement the efforts of the APD. A good example of both success and failure of this desired collaborative effort is the knife attack that occurred in Michigan. There was a successful collaborative effort between Amtrak officials and the local police with communication and response to the attack, but not in deterrence or prevention when the suspect boarded the train. However, any successful attack does circumvent the deterrence and prevention phases of the multi-layered defense of the law enforcement agencies. As this paper will show, that is the main reason why a preponderance of the available resources and efforts are placed in the two phases of deterrence and prevention.

Even though the APD offers many capabilities, these officers fulfill traditional policing functions. Their job is to act as a deterrent to crime in the stations, on trains, in and around Amtrak facilities, and out on the railroad right-of-way.<sup>66</sup> (A right-of-way is a right to make a way over a piece of land, usually to and from another piece of land. It is a type of easement granted or reserved for transportation purposes of maintenance or expansion of existing services.)<sup>67</sup> They enforce laws at the stations, on the trains, and can also assist during special political and sporting events, and provide humanitarian assistance after major weather events.

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<sup>66</sup> Amtrak Police Department, “Patrol,” accessed February 7, 2015, <http://police.amtrak.com/index.php/overview/patrol>.

<sup>67</sup> Henry Campbell Black, *A Law Dictionary Containing Definitions of the Terms and Phrases of American and English Jurisprudence, Ancient and Modern: And Including the Principal Terms of International, Constitutional, Ecclesiastical, and Commercial Law, and Medical Jurisprudence, With a Collection of Legal Maxim* (St. Paul, MN: West Publishing Co., 1910), 1040.

Since 9/11, the APD restructured and moved from traditional law enforcement to a focus on counter-terrorism and has continued to develop levels of defense as attacks happened overseas. In April of 2010 then Amtrak Chief of Police John O'Connor spoke before a Senate committee. "We are devoting our efforts to making it harder and harder for terrorists to use their preferred strategies to attack our stations, trains, and passengers,"<sup>68</sup> citing as examples rail bombing attacks in Madrid (2004), London (2005) and several in Moscow (2010), and an active shooter at a station in Mumbai (2008).

The APD has six division areas that cover the United States and incoming requests for response are monitored and coordinated by the National Communications Center. The Communication Center ensures that officers are on the scene as needed when a request for police response is made. "The NCC is staffed 24 hours a day, seven days a week, 365 days a year. Communications Officers are responsible for monitoring railroad general activity, synchronizing VIP moves, coordinating with other security agencies, and dispatching police officers for emergency and non-emergency calls for service."<sup>69</sup>

The APD, now led by Police Chief Polly Hanson, has established a multi-layered approach to mitigating terrorist attacks and protecting American's railroads. One of those APD layers of protection is the Special Operations Division, which is composed of the K-9 Units, Special Operations Unit, and the Intelligence and Counter-Terrorism Unit.

Amtrak's Police Department has approximately 60 K-9 Units that spend a majority of their time in the busiest locations, and are trained to travel on board trains that

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<sup>68</sup> Amtrak, Amtrak News Release, "Amtrak Security Efforts Aim to Defeat and Deter Most Dangerous and Likely Terror Tactics."

<sup>69</sup> Amtrak Police Department, *Annual Report 2013*, accessed February 21, 2015, [http://police.amtrak.com/images/annual\\_report.pdf](http://police.amtrak.com/images/annual_report.pdf), 28.

will allow their deployment anywhere. These K-9 teams provide a psychological, physical, and visual deterrent against criminal and terrorist threats. Each team is composed of a dog and a law enforcement handler who undergo an 11-week Explosives Detection Training program at either Auburn University Canine Detection Training Center in Alabama or the TSA facility at Lackland Air Force Base in San Antonio, Texas. At the Auburn training facility only about 20 percent of the dogs successfully complete the course and are then assigned to a handler who will undergo further training together. The explosive detection training is based on the vapor wake (plume or light breeze that a person creates when walking) that will carry particles of someone who has been handling or is carrying explosives. The dogs are specially trained to detect by smell these particles and the handlers are trained to recognize the change in their dog's behavior. The dogs can constantly sample odors in the air instead of searching items or individuals, are able to evaluate crowded areas, and can easily maneuver too many different areas. If the dog detects something in a crowded area, they have the ability to track the scent back to the source.<sup>70</sup> This has become very effective in the sense that large areas or even choke points where individuals pass through can be screened without much of a delay. A good example of the confidence in the use of this capability would be the "underwear bomber" who was able to get past security but according to the Auburn

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<sup>70</sup> Government Security News, "'Vapor Wake' Dogs Can Detect Body-Worn Explosives by Sniffing a Plume of Air," accessed April 20, 2015, [http://www.gsnmagazine.com/article/26218/%E2%80%98vapor\\_wake%E2%80%99\\_dogs\\_can\\_detect\\_body\\_worn\\_explosives\\_/](http://www.gsnmagazine.com/article/26218/%E2%80%98vapor_wake%E2%80%99_dogs_can_detect_body_worn_explosives_/).

training facility, would not have been able to escape detection of a Vapor Wake trained canine.<sup>71</sup>

This author has personally experienced this at the Kansas City airport standing in line to enter the gate area. After the person in front of me passed by the dog, I was asked to stand in my present position and about five seconds later was instructed to simply walk by the handler and dog. The dog never made any move toward me, it was unintrusive, and I was very impressed.

Some examples of the different activities or areas to check besides those discussed above are perimeter, station, vehicle, baggage room, mail room, parcels, unattended bags, and VIP security. As most dogs are trained to detect only one substance such as explosives and drugs, some dogs now are being trained to detect firearms and this would certainly contribute to the effectiveness of K-9 Units.

Another element of this level of defense would be the Special Operations Unit whose mission is to:

support APD operations by providing rapid response and enhanced capabilities to assist in keeping Amtrak passengers and employees safe. The Special Operations Unit is to be prepared at any time to deploy personnel and equipment for tactical response, to support warrant service, conduct low visibility counter-surveillance, investigations, and provide enhanced support for special events. They also conduct training on railroad-specific tactical response and procedures for fellow APD members and external law enforcement partner agencies.<sup>72</sup>

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<sup>71</sup> Auburn University, Media Production Group, "Vapor Wake Dogs," Auburn University, accessed June 7, 2015, [http://www.auburn.edu/its/telecom/video\\_media/portfolio-item/vaporwake-dogs](http://www.auburn.edu/its/telecom/video_media/portfolio-item/vaporwake-dogs).

<sup>72</sup> Amtrak Police Department, "Special Operations Unit," accessed February 8, 2015, <http://police.amtrak.com/index.php/overview/special-operations/sou>.

The special agents assigned to the Special Operations Unit specialize in handling high-risk tactical response incidents and the gathering of intelligence.

This unit is the successor to Amtrak's Office of Security Strategy and Special Operations that was stood up by the Bush Administration to address the need for a larger anti-terrorism presence in Amtrak for the protection of the United States railroad system. There never seemed to have been any question of the skills of the organization that was partially staffed with ex-military Counter Terrorism specialist<sup>73</sup>. However, much controversy grew over this group, and ultimately led to removal of authority, funding, and support of the organization.<sup>74</sup>

The Office of Security Strategy and Special Operations was not under the direction of APD but under the responsibility of Amtrak's Office of the Inspector General. The problems seem to be that they did not answer to Amtrak's Police Department, were accused of being SWAT like units, and failed to report or integrate training and exercises with the APD chain of command. Another issue was that this organization was not unionized as are most police departments, and police union officials lobbied to specific Congressional representatives and the Obama administration to support their position. This influenced the scheduling of a hearing of the Homeland Security Subcommittee of the House Appropriations Committee in April 2009 and soon after that, the Office of Security Strategy and Special Operations was dismantled along

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<sup>73</sup> Michelle Malkin, "Special Report: How Obama Cronyism Threatens Rail Security," September 11, 2009, accessed November 28, 2014, <http://michellemalkin.com/2009/09/11/special-report-how-obama-cronyism-threatens-rail-security/>.

<sup>74</sup> Michelle Malkin, "Still Handling Homeland Security with a 9/10 Attitude," September 23, 2009, accessed November 28, 2014, <http://michellemalkin.com/2009/09/23/still-handling-homeland-security-with-a-910-attitude/>.



with a resignation of the Inspector General.<sup>75</sup> There was speculation over whether the Inspector General wanted to resign, or was forced out under political pressure. This political issue had strong support on both sides and was still in the news as recently as January of 2015.

The Amtrak police Special Operations Unit responds to various high-profile events throughout the year. Some of these events include the Presidential Inauguration, Super Bowl, State of the Union Address, World Series Parade, and even Oktoberfest in Hermann, Missouri.<sup>76</sup>

Rounding out the Special Operations Division is the Intelligence and Counter-Terrorism Unit, which is another support element for the patrol divisions:

This department called the Amtrak Intelligence team consists of Detectives and Analysts assigned to the Special Operations Division that enhance the security and safety of the Amtrak system, passengers and personnel through the real-time exchange of intelligence, investigative, and threat information across the country. Two full-time Intelligence Analysts with Top Secret security clearances support these operations and routinely receive classified briefings from federal agencies as well as prepare reports and conduct analysis on threats, special events, and VIP movements. The AIT also consists of dedicated Detectives assigned to FBI Joint Terrorism Task Forces (JTTF's) and or Intelligence Fusion Centers.<sup>77</sup>

Detectives assigned to JTTF's work on investigations and threats directed at their specific geographic region as part of a larger, multi-agency team. These Detectives also support other federal investigations and issues that directly impact or occur on Amtrak property, such as counter-intelligence missions and special events. During most special events, AIT Detectives staff the various federal

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<sup>75</sup> Jeff Smith, "Amtrak Forms Anti-Terror SWAT Teams not in PD," Railroad.net, April 2009, accessed February 8, 2015, <http://www.railroad.net/forums/viewtopic.php?f=46&t=61198&hilit=amtrak+oig>.

<sup>76</sup> Amtrak Police Department, *Annual Report 2013*, 19.

<sup>77</sup> Ibid., 17.

Command Posts established and run by the FBI, US Secret Service, and the Department of Homeland Security.<sup>78</sup>

This team trains in such areas as Joint Agency SWAT training, Passenger Rail Tactical Training, and Active Shooter Training. These programs are also taught to partner agencies that help protect and respond to any incidents involving Amtrak. These teams are deployed to Amtrak stations randomly, during peak travel periods, holidays, and special events. They supplement the APD by providing an additional visual presence and conduct Random Screening operations that are both deterrent mechanisms. As mentioned above the Amtrak Intelligence Team embeds some members on the FBI Joint Terrorism Task Force. This enables information sharing on a daily basis and for those times when immediate response and collaboration is needed in circumstances such as the Boston Marathon Bombing. Amtrak and other modes of transportation collaborated to suspend some routes in leaving Boston in order to support law enforcement efforts in their attempt and ultimate capture of the terrorists.

Amtrak also works in partnership with the TSA that provides Visible Intermodal Protection and Response (VIPR) teams:

TSA's VIPR teams provide a full range of law enforcement and security capability; the exact makeup of VIPR teams is determined jointly with local authorities and can include Federal Air Marshals, Transportation Security Officers, Behavior Detection Officers, TSA certified explosive detection canine teams, Transportation Security Inspectors, Transportation Security Specialists—Explosives, explosives operational support, security and explosive screening technology, radiological/nuclear detection, and local law enforcement officers.<sup>79</sup>

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<sup>78</sup> Amtrak Police Department, *Annual Report 2013*, 17.

<sup>79</sup> Transportation Security Administration, "Visible Intermodal Prevention and Response (VIPR)," accessed February 28, 2015, <http://www.tsa.gov/about-tsa/visible-intermodal-prevention-and-response-vipr>.

TSA VIPR teams are specifically authorized by the Implementing Recommendations of the 9/11 Commission Act of 2007 to “augment the security of any mode of transportation at any location within the United States.” In order to fulfill this mission, TSA creates relationships with our various stakeholders and coordinates joint operations, promoting communication and teamwork throughout all levels of government to ensure the safety of the traveling public and the transportation systems.<sup>80</sup>

These teams can be deployed at random locations and times in cooperation with local authorities to deter and defeat terrorist activity; or teams may be deployed to provide additional law enforcement or security presence at transportation venues during specific alert periods or in support of special events. A key factor is the element of unpredictability these teams offer to the disruption of potential terrorist activities.<sup>81</sup>

Examples of additional Amtrak efforts to protect the public are the massive multi-jurisdictional Regional Alliance Including Local State and Federal Efforts (RAIL SAFE) exercise, See Something, Say Something program, Partners for Amtrak Safety and Security, and the DHS Suspicious Activity Reporting Initiative. The See Something-Say Something program is a DHS Program that was extended in 2010 to include Amtrak. The program is intended to raise public awareness of terrorism, crime and other threats and emphasizes the importance of reporting suspicious activity to speak directly with an officer, station personnel, train crew, or to contact by phone or text the Amtrak National Communication Center. “The See Something-Say Something program is promoted nationally through public education materials, advertisements and other outreach tools to engage travelers and employees to remain vigilant and play an active role rail security.”

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<sup>80</sup> Transportation Security Administration, “Visible Intermodal Prevention and Response (VIPR).”

<sup>81</sup> Ibid.

The Suspicious Activity Reporting Initiative that now includes Amtrak is a DHS program that has connected law enforcement agencies at all levels of government, which is built on the concept of a unified approach to gather, document, analyze, and most importantly share information about terrorism-related suspicious activities. The See Something-Say Something and Suspicious Activity Reporting Initiative programs are designed to generate thorough and responsible reports of suspicious activities and behaviors.”<sup>82</sup>

The Partners for Amtrak Safety and Security program is very similar to the See it-Say it program except it encourages community members to register and become an active part of protecting American’s railroad. It does provide some educational material on how to be prepared for reporting and reacting to any suspicious activity or crime.<sup>83</sup>

RAIL SAFE was developed in partnership by the APD, New York City Police Department, and the TSA. This exercise brings together the APD, Canadian National Police (Canada’s version of Amtrak Police), Canadian Border Patrol, TSA, National Guard, first responders, and local and state law enforcement officers from 32 states. These personnel deploy to passenger and transit stations to exercise counterterrorism and incident response capabilities. This exercise gives opportunity to participate in activities that require interoperability and coordination such as heightened station patrols, increased security presence onboard trains, explosives detection canine sweeps, random passenger bag inspections, and counter-surveillance. This is also an excellent opportunity to test the

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<sup>82</sup> U.S. Department of Homeland Security, “Secretary Napolitano Announces Rail Security Enhancements, Launches Expansion of ‘See Something, Say Something’ Campaign,” July 2010, accessed April 6, 2015, <http://www.dhs.gov/news/2010/07/01/secretary-napolitano-announces-rail-security-enhancements-launches-expansion-see>.

<sup>83</sup> Amtrak Police Department, “Partners for Amtrak’s Safety and Security,” accessed February 3, 2015, <https://pass.amtrak>.

coordination and communication needed for the tactical response of law enforcement helicopters and maritime assets.<sup>84</sup>

A 2013 video released by Amtrak, called “Operation RAIL SAFE,” explains that this exercise is not only for protection of the public but also for the protection of an important element of the critical infrastructure. RAIL SAFE and the everyday protection of the facilities depend mainly on the deterrent and prevention factor that the High Visibility Patrols provide. During this exercise law enforcement officers surge on over 100 Amtrak stations to practice the fundamental elements of RAIL SAFE which are described in the video as vigilance, preparation, and partnership. In many of the larger Amtrak stations, three or more jurisdictions and the Amtrak Police may police the station together such as in New York City. This exercise provides the testing of interoperability and prepares law enforcement officers and first responders for multiple types of incidents that may occur.<sup>85</sup>

The second method to create a worst-case scenario would be to place a bomb on a passenger train that would detonate as it was in transit. The bomb could be placed on the train either by a carry-on bag that is left on the train and the terrorist leaving as was the intention of the Madrid train bombings, a suicide bomber who would self-detonate, or a bomb placed in one of the few trains that require checked baggage that would explode at

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<sup>84</sup> Amtrak Police Department, “American Public Transportation Association Rail Conference” (PowerPoint Presentation, American Public Transportation Association, June 12-15, 2011), accessed March 1, 2015, [www.apta.com/mc/rail/previous/2011/Presentations/J-O%27Connor-Amtrak-Police-Dept-Protecting-America-Railroad.pdf](http://www.apta.com/mc/rail/previous/2011/Presentations/J-O%27Connor-Amtrak-Police-Dept-Protecting-America-Railroad.pdf).

<sup>85</sup> Amtrak, “Operation RAIL SAFE,” YouTube, July 2, 2013, accessed March 1, 2015, [www.youtube.com/watch?v=p7PE8x8v0PM](http://www.youtube.com/watch?v=p7PE8x8v0PM).

a later time. With all of the different methods to deter and mitigate terrorist's attacks in a resource-restricted environment, the enduring key ingredients any law enforcement entity can apply to confuse the enemy are uncertainty and unpredictability. By building and implementing multiple layers of protection that are difficult to compromise, will strengthen capabilities and become force multipliers.

The first method would be identification of the passengers on the trains. Amtrak explains on their website that they have undertaken heighten security measures for the benefit of their customers and list situations when presenting valid photo identification is required. Several of the listed situations are when obtaining, exchanging or refunding tickets, storing baggage at stations, checking baggage, sending Amtrak Express shipments, and onboard trains when in response to a request by an Amtrak employee. They continue to state, "Following federal Transportation Security Administration (TSA) guidelines, we regularly conduct random ticket verification checks onboard trains to ensure that passengers are properly ticketed. Please be prepared to show valid photo identification to a member of the onboard crew upon request."<sup>86</sup> These restrictions are in place for security reasons and are intended to deter anyone with thoughts of an attack.

However, there is an exception to this process that appears to create a security gap. That gap is the ability for passengers to board first then purchase tickets. Amtrak states on their website, "In most circumstances, you must purchase a ticket before you board a train. Most trains require reservations and passengers should not board reserved trains without a reservation. Passengers who do so are not guaranteed a seat and may be

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<sup>86</sup> Amtrak, "Passenger Identification," accessed March 8, 2015, <http://www.amtrak.com/passenger-identification>.

instructed to get off the train at the next station stop.”<sup>87</sup> This author did call Amtrak to verify this is an option, and they did confirm that on some trains anyone could board the train and then purchase a ticket. Even if there were a visual check of my identification before boarding the train, this dangerous policy would be easy to manipulate. The number of tickets purchased on long-distance Amtrak routes was not available but it could be presumed that it would be an extremely low percentage of tickets purchased. With the current security environment, and looking for ways to increase security without an increase in cost, this policy should be revisited by Amtrak officials.

The DHS and TSA have developed extensive passenger identification programs for the airline industry. One of the identification tools created by the airline industry that now contributes to national security is the Personal Name Record or information that the TSA uses for the Secure Flight program. When passengers travel, they are required to provide certain information such as name, DOB, gender, etc. and the airline submits this information to Secure Flight, which uses it to perform watch list matching. “This serves to prevent individuals on the No-Fly list from boarding an aircraft and to identify individuals on the Selectee List for enhanced screening. After matching passenger information against government watch lists, Secure Flight transmits the matching results back to airlines so they can issue passenger boarding passes.”<sup>88</sup>

The terrorist watchlist is maintained by the Terrorist Screening Center (TSC), which is administered by the FBI, U.S. Department of Justice, in

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<sup>87</sup> Amtrak, “Onboard Ticket Purchases and Pick-Up,” accessed March 8, 2015, <http://www.amtrak.com/servlet/ContentServer?c=Page&pagename=am%2FLayout&cid=1241337895872>.

<sup>88</sup> Transportation Security Administration, “Secure Flight Program,” accessed March 8, 2015, <http://www.tsa.gov/stakeholders/secure-flight-program>.

cooperation with the departments of Homeland Security, Defense, State and Treasury, and the Central Intelligence Agency. Intelligence and law enforcement agencies nominate individuals for the watchlist based on established criteria. The two subsets of the terrorist watchlist are the “No-Fly” list and “Selectee” list. The “No Fly” list includes individuals who are prohibited from boarding an aircraft. The “Selectee” list includes individuals who must undergo additional security screening before being permitted to board an aircraft.<sup>89</sup>

This seems to beg the question of why the lack of a No-Ride list for passenger trains. Of course, the No Fly list does help to prevent terrorists from flying into the United States, but that does nothing for the terrorist who could ride an Amtrak train within the United States after they have penetrated the Canadian or Mexican-United States border. The United States CBP receives voluntary, not mandated, Advanced Passenger Information System (passenger and crew information) submissions from Amtrak on any trains traveling in either direction across the United States-Canada border (presently, Amtrak does not provide service across the United States-Mexico border).<sup>90</sup> A point of emphasis must be made here about the Advanced Passenger Information System submissions are only done on a voluntary basis. This is mandated with the airline industry and for all international flights and the mandate should be expanded to include passenger rail and with Canada.

After the successful raid and death of Osama bin Laden, a review of his papers indicted a plan to derail a train in the United States. Not long after the potential Al Qaeda threat was revealed, Senator Chuck Schumer in May of 2011, proposed a No Ride list to

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<sup>89</sup> U.S. Department of Homeland Security, “Step 1: Should I Use DHS Trip,” accessed March 8, 2015, <http://www.dhs.gov/step-1-should-i-use-dhs-trip>.

<sup>90</sup> U.S. Department of Homeland Security, “Privacy Impact Assessment: Advanced Passenger Information System, Voluntary Rail and Bus Submissions (APIS-VRBS,” December 11, 2008, accessed April 22, 2015, [https://www.dhs.gov/xlibrary/assets/privacy/privacy\\_pia\\_cbp\\_apisvrbs.pdf](https://www.dhs.gov/xlibrary/assets/privacy/privacy_pia_cbp_apisvrbs.pdf).



keep terrorists off Amtrak. Schumer said, “There should be a ‘no-ride’ list for Amtrak, similar to the ‘No-fly’ list maintained by the federal Department of Homeland Security. Anyone, even a member of al-Qaida could purchase a train ticket and board an Amtrak train without so much as a question asked. So that is why I’m calling for the creation of an Amtrak ‘No-Ride list.’ That’s a glaring loophole.”<sup>91</sup> He went on to indicate that the Secure Flight program should be applied to Amtrak trains. Unfortunately, this research was unable to find any movement on this proposal to date.

There would certainly be issues to work out, such as many of the stations that are unmanned and use kiosk for ticket sales. This would require a method of verifying the ticket purchaser’s identification and comparing it to the No-Ride list. One option that could be investigated would be a version similar to TSA’s four Trusted Traveler programs. For this discussion, the PreCheck Application Program that is one of the four will serve as a basic outline and example. The TSA PreCheck program “allows low-risk travelers to experience expedited, more efficient security screening at participating U.S. airport checkpoints for domestic and international travel. Interested applicants must visit an application center to provide biographic information that includes name, date of birth and address.”<sup>92</sup> With the challenge of verifying identification at kiosk and unmanned stations, riders who choose to purchase their tickets in this manner would first have to provide proof of identification. This possible program could require a registration of once

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<sup>91</sup> NPR, “Sen. Charles Schumer Wants ‘No-Ride’ List For Trains,” accessed March 8, 2015, <http://www.npr.org/blogs/thetwo-way/2011/05/09/136146271/sen-charles-schumer-wants-no-ride-list-for-trains>.

<sup>92</sup> Transportation Security Administration, “TSA PreCheck Application Program,” accessed March 8, 2015, <http://www.tsa.gov/tsa-precheck-application-program>.

every five years as are the four Trusted Traveler programs and could be accomplished either online, at one of the already established TSA application centers, or through similar arrangement with Amtrak at minimal or no cost to the applicant. This program would then provide the same security benefits as the No-Fly list and actually increase the overall situational awareness that would come from information sharing between transportation modes and fusion centers. Having the technology to overcome similar issues and the fact that Secure Flight and the No-Fly list already provide the necessary information and template to implement a No-Ride list, leaves little reason not to take advantage of this opportunity.

Another issue that is raised in the discussion of identification checks is the verification of the identification documents. One way the TSA confirms the authentication of a Federal, State, or local government photo ID by the use of ultraviolet lights that expose and verify the proper security feature is present on the photo ID document. If the ID is found to be fraudulent then they have a resolution process established to deal with the situation.

Even with a new generation of automated ID checking technology approaching, Amtrak does not even utilize the ultra-violet method of ID document verification though it could be easily implemented at all points when purchasing a ticket and ID should be checked. The equipment used can be as small as the size of a pen and could even be used by the conductor that is selling a ticket to the passenger who boarded the train without a ticket.

This research found Amtrak's methods of screening passengers and baggage to be minimal compared to the aviation industry. It also seems somewhat unclear of the

mission, not only of the screening process for Amtrak, but of the overall protection plan of the United States passenger railroad system. Is the mission, to provide the maximum amount of security needed to prevent a terrorist attack using a risk based analysis methodology or is it to provide the maximum amount of security that will be tolerated by the industry's fast-paced schedule? If this same question is first directed in reference to the aviation industry, then the answer is obviously for providing the maximum amount of security to prevent a terrorist attack. When directed at the passenger railroad industry, the argument could easily be made for what the industry will tolerate. A few examples can be used to support this statement

There is no standardized continuous process of screening passengers, carry-on, or checked baggage. Research indicates Amtrak stations have none of the Walk Through Metal Detectors (WTMD) that are the ones most people are accustomed to that passengers set off if they forget to remove a watch, necklace, or have a medical device. These enhanced metal detectors provide the benefit of screening passengers for knives, guns, or weapons. There is no Advanced Imaging Technology (AIT) also referred to as full body scanners, which is the new version of the WTMD that requires passengers to stand in the booth with their arms up in the air. The AIT delivers the benefits of being able to screen passengers for metallic and nonmetallic threats that could be concealed, and accomplishes this without a physical pat-down. There are no advanced technology x-ray systems for carry-on baggage and all research indicates no checked baggage screening process. "Each passenger is allowed two carry-on bags not to exceed the

dimensions of 28 x 22 x 14 and 50 lbs.”<sup>93</sup> That size baggage is considered a large suitcase and all airlines require that size to be checked. That size since no carry-on bags are screened would store a large amount for the person with the intent of terrorist activity. There are no restrictions on bottled liquids and alcohol is allowed to be carried on with some restrictions where it can be consumed. In an attempt to avoid the process of checking baggage, most passengers choose to utilize the areas on the trains to store large bags, which also facilitates a quicker exit at the destination. It is well known and documented through comments on various social media outlets that many riders see the reduced level of security as a benefit and is a major part of their decision to take the train.

Amtrak does employ a security method of unpredictability and deterrence by implementing random screening procedures that includes bomb-sniffing K-9 units, passenger and carry-on screening, onboard security checks, and identification checks. The random screenings are intended to be high visibility actions that could deter or interfere with any criminal or terrorist plans.

There are also coordinated efforts when the TSA’s Visual Intermodal Prevention and Response (VIPR) teams will partner with APD.

The VIPR program applies a risk-based approach to work nationwide with transportation and law enforcement stakeholders to plan and conduct VIPR operations. The capabilities of TSA personnel are applied at transportation locations to mitigate vulnerabilities of those locations to terrorist activities. VIPR teams provide additional detection and response capabilities, and expand the unpredictability of security measures to deter and disrupt potential terrorist activity.<sup>94</sup>

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<sup>93</sup> Amtrak, “Carry-on Baggage Policy,” accessed March 17, 2015, <http://www.amtrak.com/carry-on-baggage>.

<sup>94</sup> Transportation Security Administration, “Visible Intermodal Prevention and Response (VIPR).”

The teams provide a high-visibility surge into a transit system and work with state and local security, and law enforcement officials to expand the unpredictability of security measures to detect, deter, or disrupt potential criminal and/or terrorist operations. These teams will surge on a station and move throughout the crowds talking, asking questions, and overall looking for suspicious behavior. These teams will also approach random individuals and request to perform passenger/bag searches. These searches are voluntary and if anyone refuses then they are allowed to leave the system.

Amtrak states the following on its website: “Random screenings will be completed as quickly as possible—usually in less than a minute. Passengers failing to consent to security procedures will be denied access to trains and refused carriage, and a refund will be offered.”<sup>95</sup> The question is then raised that the individual who refused to be searched and leaves the station could just go to the next closest station and board another train. The answer is yes, but the objective of deterrence was effective and possibly delayed or prevented an attempt that will provide more time for the intelligence unit to perform their job. Probably their most visible and effective capability is the bomb-sniffing K-9 teams that have the ability to smell bomb ingredients on bags, in the wake vapor as individuals pass by, and in large areas with many people in a short amount of time. Other team members randomly swab bags for explosives or are trained to notice suspicious behavior.

As discussed in chapter 2 of this research, the SPOT program is based on recognizing signs of fear, stress, or deception, then followed up by further screening

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<sup>95</sup> Amtrak, “Safety and Security,” accessed March 19, 2015, <http://www.amtrak.com/servlet/ContentServer?c=Page&pagename=am%2FLayout&cid=1241267382695>.

methods has been discredited by some but championed by others. This program and others like it are a large part of VIPR and other similar law enforcement programs. SPOT evolved through the Passenger Assessment Screening System that was derived from the Behavior Assessment Screening System (BASS).

The BASS program was created by Peter DiDomenica who has served in multiple law enforcement positions such as a Massachusetts State Policeman for over 20 years, Director of Security Policy for Boston Logan International Airport, Massachusetts State Police subject matter expert in racial profiling and biased policing, a licensed attorney in Massachusetts, and many other prestigious positions.<sup>96</sup>

Mr. DiDomenica developed the BASS program with the ability to identify potential terrorist while ensuring that profiling was removed from the process. This was important because racial, ethnic, and religious profiling is not only illegal, but could distract security officials from detecting true threats. This program would teach law enforcement personnel to recognize stress, fear, or anxiety that is manifested through involuntary physical and physiological reactions. What Mr. DiDomenica found while developing the program was “a person who is engaged in a serious deception of consequence or otherwise engage in an act in which the person has much to lose by being discovered or by failing to succeed will suffer mental stress, fear, or anxiety. Such stress, fear, or anxiety will be manifested through involuntary physical and physiological

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<sup>96</sup> U.S. Congress, House, Committee on Science, Space, and Technology, Subcommittee on Investigations and Oversight, *Statement of Detective Lieutenant Peter J. DiDomenica, The TSA SPOT Program: A Law Enforcement Perspective*, April 6, 2011, accessed February 27, 2015, <https://science.house.gov/sites/republicans.science.house.gov/files/documents/hearings/2011%2003%2031%20DiDomenica%20Testimony.pdf>.

reactions such as an increase in heart rate, facial displays of emotion, and changes in speed and direction of movement.”<sup>97</sup> Proving that the program was effective with examples such as detaining an official of the DHS Office of Investigations that was attempting to test a screening checkpoint with a concealed weapon, or another individual detained by recognizing non-verbal clue who was found to be on the terror watch list and several other incidents, the TSA took notice. He then developed a similar program, Passenger Assessment Screening System for TSA screeners that eventually became the SPOT program. There are now some differences between the original BASS program and the SPOT program. Mr. DiDomenica expresses some concern with the SPOT program used by the TSA and VIPR teams about what happens after someone is identified as suspicious. The BASS program was designed so that the suspicious person would be interviewed by police officers highly trained in the same behavior detection and interview skills. He has some concern the level of training for the responding officers may be more of a familiarization type of training which may lead to the officer not having the confidence in the validity of the program or their own ability to detect terrorist behavior.<sup>98</sup> The program was designed so that the most dangerous people either would be removed from the critical infrastructure or arrested, so if the responding officer is not highly trained in behavior detection then the possibility of a devastating error in assessment or judgment increases.

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<sup>97</sup> U.S. Congress, House, Committee on Science, Space, and Technology, Subcommittee on Investigations and Oversight, *Statement of Detective Lieutenant Peter J. DiDomenica, The TSA SPOT Program: A Law Enforcement Perspective*.

<sup>98</sup> Ibid.

That difference between the levels of training for the interviewing officer is significant. It is difficult for this research to determine the level of training in BASS for the Amtrak police officers. It is also difficult to determine if there is always an officer properly trained in BASS techniques that responds to a suspicious person stopped by a VIPR team on Amtrak property that can correctly resolve the issue.

Human Behavior detection and assessment is a vital part of the TSA's and Amtrak's layered approach to prevention and deterrence of terrorist attack on the railroad system. The ability to identify and assess involuntary physical and physiological reactions through the intentional attempts of deception is immeasurable and the most unintrusive method of screening available.

Amtrak's policy of allowing firearm's on board was mandated by a Congressional order in 2009 that reversed a firearms ban that has been in place since 9/11. The policy implement in 2010, carried the threat of losing some federal funding if they did not comply.<sup>99</sup> Of the Amtrak trains that offer the service of checking baggage, only about 35 percent meet the requirements that will allow firearms to be checked.

Amtrak will accept reservations of firearms and ammunition for carriage between Amtrak stations and on Amtrak trains within the United States that offer checked baggage service. Thruway Bus Services will not be included in this service change. The following policies are in effect:

Notification that the passenger will be checking firearms/ammunition must be made no later than 24 hours before train departure by calling Amtrak at 800-USA-RAIL. Online reservations for firearms/ammunition are not accepted.

The passengers must travel on the same train that is transporting the checked firearms and/or ammunition.

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<sup>99</sup> Mark Shone, "Congress: Passengers Can Bring Guns on Amtrak Trains," *ABC News*, December 9, 2009, accessed January 6, 2015, <http://abcnews.go.com/Blotter/congress-passengers-bring-guns-amtrak-trains/story?id=9290167>.



All firearms and/or ammunition must be checked at least 30 minutes prior to scheduled train departure. Some larger stations require that baggage be checked earlier. Please contact your departure station for more details.

All firearms (rifles, shotguns, handguns, starter pistols) must be unloaded and in an approved, locked hard-sided container not exceeding 62" L x 17" W x 7" D (1575 mm x 432 mm x 178 mm). The passenger must have sole possession of the key or the combination for the lock to the container. The weight of the container may not exceed 50 lbs. /23 kg.

Smaller locked, hard-sided containers containing smaller unloaded firearms such as handguns and starter pistols must be securely stored within a suitcase or other item of checked baggage, but the existence of such a firearm must be declared.

All ammunition carried must be securely packed in the original manufacturer's container; in fiber, wood, or metal boxes; or in other packaging specifically designed to carry small amounts of ammunition. The maximum weight of all ammunition and containers may not exceed 11 lbs. /5 kg.

The passenger is responsible for knowing and following federal, state, and local firearm laws at all jurisdictions to and through which he or she will be travelling.

All other Amtrak checked baggage policies apply, including limits on the number of pieces of checked baggage, the maximum weight of each piece (50 lbs. /23 kg).

Firearms/ammunition may not be carried in carry-on baggage; therefore, checked baggage must be available on all trains and at all stations in the passenger's itinerary.

At the time of check-in, passengers will be required to complete and sign a two-part Declaration Form.

BB guns and Compressed Air Guns (to include paintball markers), are to be treated as firearms and must comply with the above firearms policy. Canisters, tanks, or other devices containing propellants must be emptied prior to checking and securely packaged within the contents of the passenger's luggage.

Passengers failing to meet the above-mentioned requirements for checking firearms will be denied transportation.<sup>100</sup>

When comparing Amtrak's firearm policy and the TSA's Firearms and ammunition policy for airlines, Amtrak's policy is surprisingly stricter in certain areas.

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<sup>100</sup> Amtrak, "Firearms in Checked Baggage," accessed March 14, 2015, [www.amtrak.com/firearms-in-checked-baggage](http://www.amtrak.com/firearms-in-checked-baggage).

Amtrak requires a minimum 24-hour notification by directing calling Amtrak of the intent to check firearms or ammunition, while the TSA policy only requires firearms to be declared during the ticket counter check-in process. Amtrak has a limit of 11 pounds of ammunition per passenger compared to TSA's aviation policy referencing "only small amounts."<sup>101</sup> Both have similar requirements for the storage containers for the firearms and ammunition. The TSA does go into detail on the resolution process for ammunition or firearms that are improperly stored or alarms while being checked. Amtrak does not address this issue but most if not all of these concerns would be dealt with when checking the firearm. The TSA aviation policy does also restrict replicas of firearms under the reasoning that they could be used in a hijack situation.

The next level of security, the Automated Targeting System (ATS) that was launched in 2006, is operated by DHS and Customs and Border Protection (CBP), and is quite controversial. "CBP uses ATS to improve the collection, use, analysis, and dissemination of information that is gathered for the primary purpose of targeting, identifying, and preventing potential terrorists and terrorist weapons from entering the United States. ATS allows the CBP to focus their efforts on travelers and cargo shipments that most warrant greater scrutiny."<sup>102</sup>

The Automated Targeting System (ATS) operated by Homeland Security and U.S. Customs and Border protection is a decision support tool that compares traveler, cargo, and conveyance information against law enforcement,

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<sup>101</sup> Transportation Security Administration, "Firearms and Ammunition," accessed March, 14, 2015, [www.tsa.gov/traveler-information/firearms-and-ammunition](http://www.tsa.gov/traveler-information/firearms-and-ammunition).

<sup>102</sup> U.S. Department of Homeland Security, "Privacy Impact Assessment: Customs and Border Protection, Automated Targeting System," November 22, 2006, accessed March 16, 2015, [https://www.dhs.gov/xlibrary/assets/privacy/privacy\\_pia\\_cbp\\_ats.pdf](https://www.dhs.gov/xlibrary/assets/privacy/privacy_pia_cbp_ats.pdf).

intelligence, and other enforcement data using risk-based targeting scenarios and assessments. ATS compares information about travelers and cargo arriving in, transiting through, and exiting the country against law enforcement and intelligence databases to identify individuals and cargo requiring additional scrutiny. For example, ATS compares information about individuals (identified as passengers, travelers, crewmembers, or persons appearing on documents supporting the movement of cargo) trying to enter the country or trying to enter merchandise into the country against the Terrorist Screening Database (TSDB), which ATS ingests from the DHS Watchlist Service (WLS), as well as data concerning outstanding wants and warrant.<sup>103</sup>

This introduction of this program lists all of the different sources that provide data for the entry into the United States of any individual or type of cargo.

ATS receives various data in real time from the following different CBP mainframe systems: The Automated Commercial System (ACS), Automated Export System (AES), Automated Commercial Environment (ACE), and the Treasury Enforcement Communication System (TECS). ATS collects certain data directly from commercial carriers in the form of a Passenger Name Record (PNR). Lastly, ATS also collects data from foreign governments and certain express consignment services in conjunction with specific cooperative programs.

ATS accesses data from these sources, which collectively include electronically filed bills, entries, and entry summaries for cargo imports; shippers' export declarations and transportation bookings and bills for cargo exports; manifests for arriving and departing passengers; land-border crossing and referral records for vehicles crossing the border; airline reservation data; nonimmigrant entry records; and records from secondary referrals, incident logs, suspect and violator indices, and seizures.<sup>104</sup>

ATS separates the data into six different modules that center on those items listed above: Passengers and crew (international flights and crew and passengers on sea carriers), imports, exports, trends of imports, and vehicles crossing at land borders. These

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<sup>103</sup> U.S. Department of Homeland Security, "Privacy Impact Assessment Update: Automated Targeting System," September 16, 2014, accessed March 16, 2015, <http://www.dhs.gov/sites/default/files/publications/privacy-pia-cbp-atsupdate-01312014.pdf>.

<sup>104</sup> U.S. Department of Homeland Security, "Privacy Impact Assessment: Customs and Border Protection, Automated Targeting System."

six modules also provide selectivity and targeting capability to support CBP inspection and enforcement activities:

ATS-Inbound: inbound cargo and conveyances (rail, truck, ship, and air)

ATS-Outbound: outbound cargo and conveyances (rail, truck, ship, and air)

ATS-Passenger (ATS-P): travelers and conveyances (air, ship, and rail)

ATS-Land (ATS-L): private vehicles arriving by land

ATS - International (ATS-I): cargo targeting for CBPs's collaboration with foreign customs authorities.

ATS-Trend Analysis and Analytical Selectivity Program, (ATS-TAP) (analytical module)<sup>105</sup>

Initially ATS was developed as a rules-based program to identify high-risk cargo and did not apply to passengers. In 1997, ATS-Inbound and ATS-Outbound were implemented, and ATS-P followed two years later.

Another DHS/CBP system that integrates with ATS and the various intelligence watchlists is the Advanced Passenger Information System. This system currently requires commercial air, (sic) private aircraft, and vessel carriers to provide CBP with personally identifying information about passengers and crew members traveling by air or sea, and arriving in, departing from, (and, in the case of aircraft crew, flights overflying or continuing domestically within) the United States.<sup>106</sup> As with ATS, the purpose of collecting this information is to identify high-risk passengers and crewmembers who may pose a risk or threat to national security. However, this policy only mandates submission

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<sup>105</sup> U.S. Department of Homeland Security, "Privacy Impact Assessment: Customs and Border Protection, Automated Targeting System."

<sup>106</sup> U.S. Department of Homeland Security, "Privacy Impact Assessment: Customs and Border Protection, Advanced Passenger Information System (APIS)," November 18, 2008, accessed March 17, 2015, <http://www.hsdl.org/?view&did=233597>.

of this information to DHS/CBP about passengers and crewmembers that travel into the United States by air or by sea. Anyone who crosses the border by bus or rail (Amtrak) into the United States from Canada or Mexico is on that mode of transportation passenger and crewmember manifest, but the submission of those manifest are submitted to DHS only on a voluntary basis. Amtrak to their credit does voluntarily submit their manifest to the DHS for consideration. This does make one wonder why some of the transportation modes manifest submission requirements are mandatory and some are not.

The above information does raise some concerns about the level of security for passenger trains in the United States. The military trains it officers to try and think what the enemy's most likely course of action and most deadly course of action would be in a given situation. This is usually done in a war-gaming environment by a commander and his staff that is challenged by a group called the Red Team, trained to look from the enemy's perspective, for any gaps and avenues that offer the best chance of success with the available resources. There is no doubt that the United States Federal Government also has these types of teams in the intelligence community, Joint Task Forces and Fusion Centers that share information, collaborate, and plan on a daily basis to anticipate, deter, and mitigate the terrorists plans. However looking at a list of policies that were made based on convenience rather than protection, seem more significant when viewed as gaps in security or avenues of approach for attack.

1. No carry-on baggage security checks.
2. No requirement to check baggage 28 x 22 x 14 or under even when baggage checking is available. All airlines would require this size to be checked.
3. No checked baggage security checks.

4. No WTMD checks for metallic weapons.
5. No AIT checks for metallic and nonmetallic weapons.
6. No authentication of ID documents.
7. Passengers can purchase tickets after boarding.
8. No restrictions on liquids carried on board.
9. Passenger manifest submitted to DHS voluntary. Checks for passengers that pose a risk or threat to national security.

All of the items listed above are required for security reasons if traveling by airplane.

Since the items listed above are currently not part of the measures to protect the United States railroad system, then the major elements of protection left are: random security checks with VIPR teams, bomb detecting K-9 units, and programs designed to elevate awareness of passengers who are ask to say something if they see something. Again, the argument for the existing level of security for the railroad system is that it is too vast with too many entry and exit points and that imposing rigorous aviation security screening could create serious delays.

Consider this scenario: A terrorist, whose name is on the Terrorist Watch List, takes advantage of Amtrak policy and boards a train with no ticket. He knows that purchasing a ticket after boarding the train will allow no time for his name to be compared to the Terrorist Watch List. He has carried on two unchecked and unscreened suitcases each loaded with 50 pounds of explosives. He was not required to pass through metal detectors or AIT, so he was also able to carry-on several concealed firearms with plenty of ammo. He places his bags in the passenger car he has pre-selected and chooses a seat. He then purchases a ticket from the conductor who does not verify his form of ID

with an ultraviolet pen and the train is now in transit. Now he waits for the opportune time or place to carry out his mission.

Is this a worst-case scenario? Yes, it probably is, but this scenario, although planning intensive, provides a terrorist many gaps in security to capitalize on, and is also one that requires very little luck to be accomplished. Despite the vulnerabilities that were just pointed out, is there a course of action for a terrorist that would require even less effort, provide less risk of being caught before he boards the train, and accomplish the same results? The third method to create a worst-case scenario is the derailling of a full Amtrak train or a freight train that contains tank cars loaded with either Poisonous Inhalation Hazard chemicals or flammable liquids that derails as it passes through a town or city.

### Deraillments

A very simple idea that would kill scores of people and pave the way for more acts of terrorism was how the two men described their plot to derail a Canadian Via passenger train that would crash between New York and Toronto. The secret audio recordings that were played at the trial of the two men, one from Tunisia and another from Palestine, explained how they would carry out the terrorist attack on a passenger train targeting Americans and Canadians. It is very interesting to read the statements of the men that describe their thinking, planning, and how they justify killing innocent men, women, and children.

The train is going very fast on the railway, but it's on the bridge. So like before the train passes by, an hour or two, what do we do, we make a hole in the bridge.

That hole would be made by two people disguised as construction workers and would be about five to six meters big.

So when the train is going very fast on the bridge he cannot see the hole and when he start to see the hole he start to decrease speed—it's too late for him.

He will go through the hole . . . and it will be a big accident. Many people they will die. It's a very simple idea. There is no missile, nothing.

The attack would be carried out in December, after dark, he said, telling the undercover officer that the plan was referred to in code as “going fishing.” The attack also targeted a train between the U.S. and Toronto to ensure both Americans and Canadians were victims, he said.

Finally, the plan included a video, which would warn of further attacks. We will say this operation is just the beginning. If you don't get out from our land we will do more and more, he is heard saying. Because Canada and America have armies.

Civilians would be targeted because the Canadian and American governments used taxpayers' money in their missions in Muslim countries overseas. So we cannot say that they are civilian, no, they are participating in the war against our brothers. They are in the military too, but they are in the military with civilian clothes.<sup>107</sup>

Other comments made by the terrorist included “hoping to assassinate Canadian leaders, and prominent Jews” and the disappointment of the train plot that was “a lot of work to kill only 50 or 60 people.”<sup>108</sup>

One of the men was found guilty of the following:

Conspiring to murder persons unknown for the benefit of a terrorist group.

Conspiring to interfere with transportation facilities for the benefit of a terrorist group.

Three counts of participating in the activities of a terrorist group.

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<sup>107</sup> Montreal Gazette, “Train Derailment Plot ‘Very Simple Idea,’ Via Rail Terror Trail Hears,” February 3, 2015, accessed May 11, 2015, <http://montrealgazette.com/news/local-news/via-rail-terror-plot-trial-continues-in-toronto>.

<sup>108</sup> Michele Mandel, “Trail Begins for Via Rail Terror Plot Suspects,” *Toronto Sun*, February 2, 2015, accessed May 12, 2015, <http://www.torontosun.com/2015/02/02/trial-begins-for-via-rail-terror-plot-suspects>.



The second man was charged and found guilty of the following:

Conspiring to murder persons unknown for the benefit of a terrorist group.

Two counts of participating in the activities of a terrorist group.<sup>109</sup>

As of the time of this research, the convicted terrorists of the plot to intentionally derail a Via Rail passenger train, with the intent to murder as many innocent people as possible have not been sentenced.

Throughout this authors research, there have been many statements read about the intelligence of terrorists. My conclusion and one that is confirmed by the statements of these terrorists, is that acting out evil does not display intelligence in any manner, but only displays the simple willingness to carry out the murderous act.

Over the last 10 years, not including 2015, there have been approximately 1,450 combined passenger and freight derailments per year in the United States.<sup>110</sup> Freight derailments account for approximately 95 percent of those derailments and most were attributed to faulty track and infrastructure, equipment problems, and human error. Train derailments can have serious sometimes-deadly consequences, causing significant delays for passenger and freight, and can cause environmental damage as seen with spillage from derailed freight tank cars.

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<sup>109</sup> CBC News, "Via Rail Plot Trail: Raed Jaser, Chiheb Essenghaier Found Guilty on Several Terror Charges," March 20, 2015, accessed May 15, 2015, <http://www.cbc.ca/news/canada/toronto/via-rail-plot-trial-raed-jaser-chiheb-esseghaier-found-guilty-on-several-terror-charges-1.3001383>.

<sup>110</sup> Federal Railroad Administration Office of Safety Analysis, "Freight/Passenger Operations Ten Year Overview," U.S. Department of Transportation, accessed March 31, 2015, <http://safetydata.fra.dot.gov/OfficeofSafety/publicsite/Query/TenYearFreightPassengerOperationsOverview.aspx>.

Rail inspection is a major component of railroad safety, and rail inspection technology has become more vital as accidents involving trains carrying loaded tank cars have brought into question the reasons for the derailments. “Railroads inspect their infrastructure and equipment using specialized technology such as track geometry cars, ground-penetrating radar, and wayside detectors positioned throughout their network. This equipment allows railroads to schedule maintenance in a timely and cost-effective manner and has significantly improved the overall safety of the rail network.”<sup>111</sup>

This author has found that even though the percentage of intentional derailments is very small, it does happen. There are several ways to compromise the integrity of the rails resulting in a passenger or freight train derailment. A Norfolk Southern train in 2011 was intentionally derailed in Southside Virginia by placing an object on the tracks. Fortunately, the locomotive that was pulling the train of agricultural products was the only element of the train that derailed, while the rest of the cars remained on the tracks.<sup>112</sup>

Near Eyota, Minnesota in 2014, the local sheriff’s office responded to a call that someone had removed 17 spikes from the railroad tracks:

Investigators believe this was an intentional plan to derail a train because only the spikes on one side of the tracks were removed, and on a curve in the tracks making the chances of a train derailment higher. Olmsted County Sheriff Dave Mueller said if a train went over that curve, the plates would have pushed out and caused the train to go off the tracks. Propane is mostly transported on the

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<sup>111</sup> Association of American Railroads, “Technology,” accessed May 2, 2015, [www.aar.org/todays-railroads/technology](http://www.aar.org/todays-railroads/technology).

<sup>112</sup> Caitlin O’Brien, “Virginia Train Derailment Intentional,” *NBC News*, August 15, 2011, accessed April 1, 2015, <http://www.nbcwashington.com/news/local/Train-Derailment-Intentional-127736443.html>.

route. That's a highly volatile fuel, so potentially that could cause a significant fire.<sup>113</sup>

There are also occasions of a distressed suicidal person who intentionally parks their vehicle on a railroad crossing that causes an accident and derailment. More than likely, this person is only concerned about their own death and not purposely trying to derail the train. The majority of train derailments whether passenger or freight caused by the railroad system infrastructure can be credited to rail integrity (broken rails or faulty welds), defective wheels or axels, rail geometry, or switching equipment.

In 2001, in Nodaway, Iowa, a derailment of an Amtrak train sent 11 of the 16 passenger cars off the tracks leaving 78 injured and one dead. The National Transportation Safety Board identified the cause of the derailment as a broken rail that was discovered at the point of derailment of Amtrak's California Zephyr. It was determined that the section of rail that failed had been installed a month earlier as a replacement or plug rail but was not known if the failure was the rail itself or installation.<sup>114</sup>

Deraillments happen in various stages of seriousness, but most are small and can be quickly corrected. There are situations when trains are intentionally derailed, and it is most always to protect the tracks, infrastructure, and most importantly workers. Sometimes in order to prevent a much larger disaster, it becomes necessary to

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<sup>113</sup> Kimberly Davis, "17 Spikes Taken from Train Tracks Near Eyota," *KTTC*, May 28, 2014, accessed April 1, 2015, <http://www.kttc.com/story/25632317/2014/05/28/17-spikes-taken-from-train-tracks-near-eyota>.

<sup>114</sup> Federal Railroad Administration, "Track Safety Standards; Improving Rail Integrity," U.S. Department of Transportation, January 24, 2014, accessed March 31, 2015, <http://www.fra.dot.gov/eLib/Details/L04920>.

intentionally cause a smaller accident (derailing). This author found at least three companies that manufacture and sell devices online designed for the purpose of derailing a train. This type of equipment is called a Derail or Derailer and is designed to prevent unauthorized movements of trains or unattended rolling stock (any type of vehicle that moves on a railway). These devices can best be described as a heavy metal vertical wedge or ramp that is attached to one of the rails. The intent is to lift the wheel flange of the train up and off the rail, forcing it to the outside, which causes the derailment. In a controlled environment, this is an excellent way to minimize damage to property and save human life.<sup>115</sup>

In a 2003 bulletin, the FBI reported the theft of nine of the derailleurs from rail yards:

Devices that could be used by terrorists to derail trains are being stolen from rail facilities around the country, the FBI warned. The theft of these items is strange since they are of little use outside of the rail industry, according to the bulletin. Railroads have been targeted in the past by terrorists, the bulletin said. It specifically mentioned the intentional Oct. 1995 derailment of an Amtrak train in Hyder, Ariz. In that incident, one person was killed and 78 were injured when parts of the track were sabotaged. The FBI located a derailer 50 miles from Hyder, AZ.<sup>116</sup>

The FBI in April of 2015 offered \$310,000 reward in this deadly train derailment. “Officials from the FBI and Amtrak recommitted to the pursuit and capture of the saboteurs involved in the derailment.” We want to send a message to those responsible to this senseless act of sabotage,” said Mark Cwynar, assistant special agent for the FBI.

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<sup>115</sup> Western-Cullen-Hayes Inc., “Western-Cullen Hayes Derails,” Company catalog, accessed April 1, 2015, <http://www.wch.com/pdf/catalog/hingedrls.pdf>.

<sup>116</sup> Jason Ryan, “Nine Train Derailers Taken,” *ABC News*, May 8, 2003, accessed April 26, 2015, <http://abcnews.go.com/US/story?id=90646>.

“We are very close. We are watching and we will bring you to justice.” Before the derailment, the saboteurs pulled more than two dozen rail spikes, pried the tracks apart, and ran a wire across the gap to bypass the electronic warning system.”<sup>117</sup> Another incident in 2009, in Toledo, Ohio, a derailler was reported stolen from a chemical company that had a fenced-in rail yard used for its distribution of product by rail.

Derailments have varying consequences that can range from minimal damage to devastating effects. There have been several recent incidents involving freight trains carrying tank cars loaded with flammable or toxic liquids that have pushed the discussion of derailments not only into the media but also into the political world.

In February 2015, a CSX freight train with 109 tank cars, each carrying up to 30,000 gallons of crude oil, derailed near unincorporated Mount Carbon, West Virginia, and erupted in flames. It was estimated that 20-25 of the tank cars caught fire and eventually had to burn themselves out. The derailment resulted in the towns evacuation of hundreds of families, loss of one home, and the loss its drinking water and electricity.<sup>118</sup> Fortunately, there was no loss of life and only one person was treated for smoke inhalation.

In March of 2015, in Galena, Illinois, a freight train carrying 103 tank cars loaded with Bakken crude oil left the tracks and five of the cars initially ruptured and caught fire.

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<sup>117</sup> Ryan Van Velzer, “FBI Offers \$300,000 Reward 20 Years after Train Derailment,” *FOX 6 WBRC*, April 10, 2015, accessed April 26, 2015, <http://www.myfoxal.com/story/28772894/fbi-offers-300000-reward-20-years-after-train-derailment>.

<sup>118</sup> FOX News, “Oil Tanker Cars Involved in West Virginia Train Derailment Had Been Upgraded for Safety,” February 18, 2015, accessed April, 28, 2015, <http://www.foxnews.com/us/2015/02/18/oil-tanker-cars-involved-in-west-virginia-train-derailment-had-been-upgraded/>.

Witnesses reported seeing the fireball from miles away. The only access to the train wreck site for firefighters was a bike path, and because of the intensity of the flames, had to pull back and allow the blaze to burn itself out, according to Galena fire officials.<sup>119</sup> There was no loss of life.

These are not examples of terrorism however they are situations that reveal what the result could be if someone were to intentionally derail a train at a strategic location. This also leads to the question: Would it be easier and less conspicuous to derail a train by compromising the rails rather than put forth the effort of detonating a bomb on the rail or on the train? Before this question is addressed, this paper will first provide some context of freight rail and insight to the industry as a whole.

It was very interesting and sad as this research paper is being written, that a breaking news story alerts on my cell phone about an Amtrak wreck in Philadelphia. As this incident unfolds, the reports are that the train entered a curve traveling at a speed of 106 miles per hour with a curve speed limit of 50 miles per hour. The update is now eight dead and over 200 injured.<sup>120</sup>

### Freight Rail

Today, the United States freight rail network is widely considered one of the most dynamic freight systems in the world. The \$70 billion industry consists of 140,000 rail

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<sup>119</sup> NPR, "Derailed Oil Train Continues To Burn In Illinois," March 7, 2015, accessed May 1, 2015, <http://www.npr.org/blogs/thetwo-way/2015/03/07/391368331/derailed-oil-train-continues-to-burn-in-illinois>.

<sup>120</sup> Ted Mann, Andrew Tangel, and Kris Maher, "Amtrak Crash: Train Hit Curve Going Over 100 MPH," *Wall Street Journal*, May 14, 2015, accessed May 14, 2015, <http://www.wsj.com/articles/deadly-train-wreck-in-philadelphia-leaves-disastrous-mess-1431499608>.

miles operated by seven Class I railroads that are classified as railroads with operating revenues of \$433.2 million or more, 21 regional railroads, and 510 local railroads. Not only does the 140,000 mile system move more freight than any other freight rail system worldwide but it also provides 185,000 jobs across the country and numerous public benefits including reductions in road congestion, highway fatalities, fuel consumption and greenhouse gasses, logistics costs, and public infrastructure maintenance costs.<sup>121</sup>



Figure 1. Waybill Sample, 2010–All Commodities

*Source:* U.S. Department of Transportation, Federal Railroad Administration, “Where Freight Moves,” U.S. Department of Transportation, accessed May 1, 2015, <https://www.fra.dot.gov/Page/P0362>.

<sup>121</sup> Federal Railroad Administration, “Freight Rail Today,” accessed April 28, 2015, <https://www.fra.dot.gov/Page/P0362>.

“Freight railroads serve nearly every industry, wholesale, retail, and resource-based sector of the U.S. economy. With a network that runs from one end of the country to the other, freight railroads work to connect businesses with each other across the United States and with markets overseas.”<sup>122</sup>

The railroads are described as the backbone of America’s freight transportation system. The United States railroads account for approximately 40 percent of all freight that is more than any other transportation mode. Industries and America’s economy rely heavily on freight rail to move such products as:

1. 70 percent of all coal that produces 40 percent of electricity in the United States.
2. 30 percent of all United States grain.
3. 60 percent of all autos produced in the United States.<sup>123</sup>

Another way to depict the impact of the railroad is to present the amount of products delivered in terms of freight carloads, trailers, and containers:

1. Consumer Goods: 12.8 million trailers and containers of such items as computers, appliances, and furniture.
2. Coal: six million carloads, enough to power approximately 81 percent of American homes. Each carload of coal is enough to power 62 homes for a year.

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<sup>122</sup> U.S. Department of Homeland Security, *Transportation Systems Sector-Specific Plan, An Annex to the National Infrastructure Protection Plan 2010*, accessed May 2, 2015, <https://www.dhs.gov/xlibrary/assets/nipp-ssp-transportation-systems-2010.pdf>, 283.

<sup>123</sup> BNSF Railway, “Rail Renaissance: The Changing Dynamics of Freight Transportation” (PowerPoint Presentation), accessed April 30, 2015, [http://www.usda.gov/oce/forum/2015\\_Speeches/JMiller.pdf](http://www.usda.gov/oce/forum/2015_Speeches/JMiller.pdf).



3. Chemicals: 2.4 million carloads of essential chemicals.
4. Paper and Lumber: 1.3 million carloads for construction, newsprint, and carloads of scrap paper for recycling.
5. Motor Vehicles: 1.7 million carloads of finished vehicles, parts, and accessories that support the auto industry.
6. Agricultural and Food Products: 1.3 million carloads of wheat, corn and other products for domestic use and for transport to ports for worldwide distribution.<sup>124</sup>

Without a doubt, our nation's economy is dependent upon the freight railroad system and its ability to deliver the necessary products effectively and efficiently. Since the freight railroad industry is such a vital part of the American economy, any lengthy major disruptions or delays would be felt by the consumer and the economy. Even with all the planning that goes into an industry such as freight rail, an aggregation of a surging crude oil industry, bad winter weather, and an exceptionally good grain harvest led to a shortage of freight trains causing major delays.<sup>125</sup>

A good business plan for any manufacturer would include built in tolerances to help reduce the effects of any type of delays that would affect production and delivery. However, these well-placed tolerances were almost not enough for some industries in 2014, when a shortage of freight trains for delivery of products caused many problems. This caused a ripple effect across many industries that led to delayed delivery of key

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<sup>124</sup> Association of American Railroads, "Freight Rail," accessed January 15, 2015, <https://www.aar.org/railroad-101>.

<sup>125</sup> Ron Sterk, "A Logistical Nightmare," *Food Business News*, February 26, 2014, accessed May 1, 2015, [http://www.foodbusinessnews.net/articles/news\\_home/Business\\_News/2014/02/A\\_logistical\\_nightmare.aspx?ID={B23E73FD-42DC-4926-A651-69DD095CC54}](http://www.foodbusinessnews.net/articles/news_home/Business_News/2014/02/A_logistical_nightmare.aspx?ID={B23E73FD-42DC-4926-A651-69DD095CC54}).

resources for production. Several utility companies felt the effects of this shortage when oil companies were paying high prices to the freight railroad companies for tank car delivery of their product from the Bakken Shale region in North Dakota. This essentially led to fewer freight trains available to deliver the needed coal to the utilities companies to generate electricity. Most utility companies keep a 30-day supply on hand for small unavoidable delays, but some were getting down to under 10 days before they the railroad companies would deliver the coal. “An executive close to big utility companies says coal-fired power plant inventories are running much lower than the usual 30 days. The railroads tell us they aren’t serving power plants until their inventories are in single-digit days.”<sup>126</sup> Even members of Congress wrote letters to the United States Surface Transportation Board for help in solving the problem that was focused mainly on the freight company’s inability to meet the demand. The Surface Transportation Board is a body within the DHS that has broad economic regulatory oversight of railroads, including rates, service, construction, acquisition, and abandonment of rail lines.<sup>127</sup> A combination of a large grain harvest, an exceptionally bad winter, and the booming crude oil business overwhelmed the capacity of the freight railroad system. “Severe cold slows switching activity and reduces the effectiveness of air brakes, forcing railroads to run more but shorter trains, which may add to congestion.”<sup>128</sup> Farmers were unable to haul grain from

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<sup>126</sup> Betsy Morris, Jacob Bunge, and John Miller, “Surge in Rail Shipments of Oil Sidetracks Other Industries,” *Wall Street Journal*, March 13, 2014, accessed May 1, 2015, <http://www.wsj.com/articles/SB10001424052702304914904579437680173044774>.

<sup>127</sup> Surface Transportation Board, “Overview of the STB,” accessed April 30, 2015, <http://www.stb.dot.gov/stb/about/overview.html>.

<sup>128</sup> Sterk.

their farm storage to the elevator because the grain could not be moved to market. This caused an interesting problem of too much grain on the production end but a shortage for those who needed the grain to make their products because it could not be delivered.

Parts of the agricultural sector are experiencing the worst logistics problems in memory. Many in the trade, while acknowledging the impact of record crop production in Canada and the United States, strong exports and the most severe winter weather in years, are pointing fingers at increased competition for locomotives and engineers as railroads move huge volumes of shale oil from the Upper Midwest at the implied expense of grain, oilseeds, sugar and other agricultural products.<sup>129</sup>

Deliveries were reported to be up to three weeks behind and most of the attention was on Burlington Northern Santa Fe (BNSF) Railway, whom is the major railroad serving the regions most affected.

“The railroad knew it was in trouble when winter hit. We found ourselves behind the curve,” said Bob Lease, vice president, service design and performance, for BNSF. “Now, we are finding we can’t fill all of the demand as quickly as usual.” “The backlogs could wind up costing shippers hundreds of millions of dollars,” says Steve Sharp, president of Consumers United for Rail Equity, a group representing agriculture companies, manufacturers, and utilities.<sup>130</sup> His group has been pushing for tougher railroad regulation.

Another industry in the region that was being negatively impacted by the train delays and seeking help from the Surface Transportation Board was the sugar industry. Having to wait twice as long for the empty rail cars to show up, caused shipment delays, full storage bins, and concern of losing sugar contracts. One sugar company that

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<sup>129</sup> Sterk.

<sup>130</sup> Morris, Bunge, and Miller.

purchased its own train cars for delivery of coal to power their sugar processing plants still battled the shortage of locomotives and crew to move the cars. The trainloads of coal were showing up late causing delays in manufacturing and shipment of their product.<sup>131</sup>

These examples give some understanding of how tightly interwoven the freight network is and how uncertainty and the inability to forecast future demands can affect an industry. Some additional benefits of the freight rail industry are:

1. The ability to be part of the United States intermodal system that connects to a global economy.
2. Ease highway congestion as one typical freight train with 125 cars is equal to several hundred trucks on the highway.
3. On average, trains are four times more fuel-efficient than trucks.
4. Freight railroads account for approximately 40 percent of the intercity freight volume but reduce greenhouse gas emissions 75 percent compared to trucks.
5. Provides over 185,000 jobs and another additional one million jobs are attributed to the companies that provide services and goods or are recipients of spending by the employees of railroads and their suppliers.
6. Easing taxpayer burdens by operating on an infrastructure that is funded almost entirely by the privately owned railroads. An infrastructure they built, own, maintain, and

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<sup>131</sup> Dan Gunderson, "Farmers, Elevators Fume at Costly Grain Train Delays: Oil Trains to Blame?" *MPR News*, March 26, 2014, accessed April 30, 2015, <http://www.mprnews.org/story/2014/03/26/business/train-delays>.

pay for themselves, unlike the other modes of transportation such as trucks, barges, and airlines that is funded mainly by taxpayers.<sup>132</sup>

The freight rail industry has certainly invested not only in their own equipment but has also reinvested in other elements of the infrastructure to improve the rail system and the economy. “From 1980 to 2014, the overwhelmingly private freight railroads have invested \$575 billion of their own funds on locomotives, freight cars, bridges, tracks, tunnels, and other equipment and key elements of the system. In 2015, America’s freight railroads plan to spend an estimated \$29 billion to sustain and enhance the network on which America’s economy rides.”<sup>133</sup>

One example of the private freight companies investing in the infrastructure is BNSF. Burlington Northern Santa Fe Railway was the name of the railroad from 1996 until 2005, when it officially changed its name to the initials of its original name.<sup>134</sup> In part of a video released by the AAR, Stephanie Swanson, a Structures Design manager, explains the efforts of the freight railroad companies to maintain the over 100,000 railroad bridges. Using the original Crooked River Gorge Bridge in Jefferson County, Oregon, with a span of over 460 feet as an example of one bridge that BNSF is responsible for maintaining. The bridge was built in 1911 with 40,000 rivets, and stands 320 feet above the canyon floor. She explains how “we inspect our bridges twice a year,

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<sup>132</sup> Association of American Railroads, “Overview of America’s Freight Railroads.”

<sup>133</sup> Ibid.

<sup>134</sup> BNSF, “BNSF Adopts New Corporate and Subsidiary Logos and Changes Name of Railway Subsidiary as Part of Tenth Anniversary Celebration,” January 24, 2005, accessed April 30, 2015, [https://www.bnsf.com/media/news/articles/2005/01/2005\\_01\\_24a.html](https://www.bnsf.com/media/news/articles/2005/01/2005_01_24a.html).

some three or more times depending on the condition and type of bridge.”<sup>135</sup> All maintenance whether bridge, tunnel, or track is paid for by the railroads themselves. In contrast, a new bridge for vehicles not far away, paid for by tax dollars, completed in September of 2000, is considered a great success, an engineering landmark, and an impressive sight to see in the Oregon landscape. However, even more impressive is the weight of a 100-car freight train, each car loaded with coal, safely crossing over a 100-year-old bridge because of the investment provided by the BNSF team.

The private freight companies have shown through time and extreme circumstances such as weather events, that although infrastructure always needs updating, they are willing to invest in the railroad system. On the other hand, as seen in the examples of not anticipating the need, they were overwhelmed by a combination of events (crude oil, winter weather, large harvest) that caused a shortage in equipment (locomotives and cars) to meet the demand.

Establishing the fact of how crucial the freight train industry is to our economy and the delicate balance of the meeting the high volume of service and the planning to mitigate the effects that uncertainty can have on the industry’s capacity to deliver that service, is vital in understanding how consequential a terrorist attack could be. Terrorist attacks on the freight railroad system would most likely target either the infrastructure such as the rails, bridges, and tunnels, the trains themselves that carry tank cars loaded with flammable and toxic chemicals, or a cyber-attack on the freight companies control center.

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<sup>135</sup> Association of American Railroads, “Building America, Maintaining our Rail Bridges,” accessed May 1, 2015, <http://freightrailworks.org/>.

When considering which elements of the freight railroad system would have the greatest negative effect on service and the economy if compromised by a terrorist attack, some insight can be gained by past events. When examining the potential of an attack that would damage rails, bridges, or rail yards and its effects on the system, examples can be used from damage caused by hurricanes:

The freight rail network in the United States is divided by the Mississippi River. Operations to the east are dominated by CSX Transportation and Norfolk Southern and to the west by the Union Pacific and the BNSF Railway. The major eastern gateway hubs, where the railroads interchange transcontinental shipments are Chicago, St. Louis, Memphis, and New Orleans. At New Orleans, CSX interchanges over 1,000 cars per day with the western railroads. A disruption to any of the four major gateways ripples immediately through the entire U.S. rail network.<sup>136</sup>

Hurricane Katrina in 2005 caused extensive damage to tracks, bridges, drawbridges, and to Gentilly Yard in New Orleans. Just the CSX railway alone had damage to:

Pascagoula, Mississippi to New Orleans, Louisiana

- Severe to total destruction 100 miles
- Six major bridges—23,600 track feet
- Six smaller bridges
- 40 miles of washouts/roadbed reconstruction
- 142,000 feet of debris
- 20,450 tons of rip-rap rock
- 26 miles of roadbed track placed back

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<sup>136</sup> Lance Grenzeback and Andrew Lukmann, “Case Study of the Transportation Sector’s Response to and Recovery from Hurricanes Katrina and Rita” (Cambridge Systematics, Inc., Cambridge, MA), accessed May 1, 2015, <http://onlinepubs.trb.org/onlinepubs/sr/sr290GrenzenbackLukmann.pdf>.

- 24,000 ties
- 2,401 carloads ballast (214,640 tons)
- 200 miles surfaced
- 265,000 feet rail adjusted<sup>137</sup>

Damage was so extensive on the line that CSX required more than five months and \$300 million to complete repairs and reopen the line. The major CSX rail yard in New Orleans (Gentilly) also sustained significant damage and required considerable reconstruction. While repair work was underway, CSX coped by using the track of other less-hard-hit railroads in the region and by rerouting freight interchanged with the western railroads as far north as the St. Louis Mississippi River crossing. Norfolk Southern's line into New Orleans received significant damage. Nearly five miles of track were washed from the top of the 5.8 mil-long-rail bride and into Lake Potchartrain.<sup>138</sup>

During Hurricane Sandy, the major effect on Amtrak and freight was the flooding of tunnels that caused delays, reroutes, and cancellations. Estimates for having to pump out the tunnels and the total loss of most of the switching and electrical systems cost millions of dollars. "Due to the flooding of a major electrical substation in Kearny, NJ and Amtrak's tunnels connecting New York and New Jersey under the Hudson River, passenger train service was suspended for nearly a week in parts of the Northeast Corridor and full service was not restored until three weeks later. The 100-year-old tunnels provide the only direct intercity and freight rail access from New Jersey to Manhattan."<sup>139</sup>

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<sup>137</sup> Mark Brass, "Hurricane Katrina Reconstruction" (PowerPoint Presentation, CSX Transportation, 2006), accessed May 1, 2015, [https://www.arena.org/files/library/2006\\_Conference\\_Proceedings/001.pdf](https://www.arena.org/files/library/2006_Conference_Proceedings/001.pdf).

<sup>138</sup> Grenzeback and Lukmann.

<sup>139</sup> Amtrak, "Hurricane Sandy," November 11, 2012, accessed May 1, 2015, [http://www.commerce.senate.gov/public/?a=Files.Serve&File\\_id=c449a06d-c1d6-41be-8326-8e625faeb211](http://www.commerce.senate.gov/public/?a=Files.Serve&File_id=c449a06d-c1d6-41be-8326-8e625faeb211).



In the Midwest, flooding is very common and affects the railroad infrastructure. Railroads call on contractors to rebuild track washed away or remove debris from lines. Flooding affected Indiana in 2008, where a section of track 30 miles long was damaged and other areas of 15 to 20 mile sections had to be repaired. During Hurricane Katrina, six miles of track largely intact were force upward into a line of nearby trees. Although efforts were required to reroute the trains around these damaged sections, all of the damage was repaired and service restored within a matter of days, weeks, or months.

With these examples of the resiliency of the railroad system to respond to such massive amounts of destruction brought on by weather and continue to function with limited capabilities until they can quickly rebuild the system, the possibility of a terrorist attack on the tracks, bridges, tunnels' dramatically affecting the economy is unlikely. More than likely it would be a single act of terrorism that would purpose to create fear and publicity. The freight rail's agile and adaptable system and its ability to reroute, rebuild, and collaborate with other railways in times of emergency have proven the strength of the system.

The private freight companies have shown through time and extreme circumstances such as weather events, that although infrastructure always needs updating, they are willing to invest in the railroad system. On the other hand, as seen in the examples of not anticipating the need, they were overwhelmed by a combination of events (crude oil, winter weather, large harvest) that caused a shortage in equipment (locomotives and cars) to meet the demand. These types of events can affect the economy in the short term and if not remedied quickly can have extended and lasting consequences.

In the derailment portion of this paper, two examples were presented that showed the effects of tank cars derailling and exploding but fortunately happening in a location that resulted in no loss of life. As mentioned above another possible avenue for a terrorist attack would be targeting tank cars that are loaded with flammable or toxic liquids. There are several methods terrorists could employ to accomplish this, but it most certainly would be planned with the intent of causing as much damage and loss of life as possible. It could be with any type of explosive device, those placed on the tracks to derail the train, on the tank car itself, or a type of shoulder launched-weapon. There are several methods of derailling a train that have been used and discussed in this paper, the removal of spikes, rails, or possibly using derailling equipment. All of these have the potential to cause a massive explosion that will immediately be on the local and national news, but one that happens in just the right location, a populated area, is devastating. The question was earlier asked, would it be easier and less conspicuous to derail a train by compromising the rails rather than put forth the effort of detonating a bomb on the rail or on the train? This author feels that in some cases the answer to that question is yes. This would depend on the location, terrain, and knowledge of the system. Unfortunately, many variables come into play and a clear-cut answer would be difficult to give. The examples of tank cars derailling and exploding as described below provides some evidence that derailments could cause more damage and sometimes more devastation than was earlier thought.

### Tank Cars

Such a devastating accident happened on July 6, 2013, in the town of Lac-Mégantic, in the eastern part of Quebec, Canada. On the evening of July 5th a Montreal-

Main-Atlantic Railway freight train carrying over two million gallons of petroleum crude oil in 72 tank cars arrived in Nantes, Quebec to stop for the night. The train had originated in New Town, North Dakota and had passed through Minneapolis, Milwaukee, Chicago, Detroit, Toronto, and Montreal before stopping for the night with an ultimate destination of Saint John, New Brunswick.

The train was parked on a descending grade that is keeping in the railway's policy. The engineer then applied the hand brakes and then verified through required testing that this would hold the train in place. However, he had also applied addition air brakes that gave a false impression that the hand brakes alone would hold the train. The engineer then contacted his company to advise the train was secure, but reported mechanical difficulties throughout the trip and was still showing some issues. They both agreed to leave the train there until the morning and the engineer left for a hotel.<sup>140</sup>

Early the next morning a 911 call reported a fire on the train that was extinguished by local firefighters. The firefighters and the track foreman (who had no locomotive operations experience) discussed this issue with the company and all agreed that the train was secure. When the firefighters first arrived, they had shut off the locomotive's fuel supply and shut off the electrical breakers inside the cab in keeping with railway instructions. This action turned off the air compressor that supplied air to the air brakes. Eventually enough air leaked from the air brakes to reduce their effectiveness and the hand brakes could no longer hold the train. At this point the train with 72 tank

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<sup>140</sup> Transportation Safety Board of Canada, *Lac-Mégantic Runaway Train And Derailment Investigation Summary* (Gatineau, QC: Minister of Public Works and Government Services, 2014), accessed March 21, 2015, <http://www.tsb.gc.ca/eng/rapports-reports/rail/2013/r13d0054/r13d0054-r-es.asp>.

cars full of flammable liquid began to roll downhill toward Lac-Mégantic, just over seven miles away. As it moved down the grade, the train picked up speed, reaching a top speed of 65 miles per hour and derailed near the center of the town at about 1:15 in the morning.

Of the 72 tank cars, 63 derailed and almost all of those were damaged, and many had large breaches. About six million liters of petroleum crude oil was quickly released. The fire began almost immediately, and the ensuing blaze and explosions left 47 people dead. Another 2,000 people were forced from their homes, and much of the downtown core was destroyed.<sup>141</sup> The oil that night ran down the streets into the drainage system that led underneath the town helping to spread the inferno, massive explosions, and destruction.

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<sup>141</sup> Transportation Safety Board of Canada, *Lac-Mégantic Runaway Train And Derailment Investigation Summary*.



Figure 2. Aftermath of the Oil Train Explosion in Lac-Mégantic, Canada

*Source:* Paul Chiasson, “Aftermath of the Oil Train Explosion in Lac-Mégantic, Canada,” *The Guardian*, August 19, 2014, accessed April 2, 2015, <http://www.theguardian.com/world/2014/aug/20/lac-megantic-oil-train-disaster-inquiry-finds-string-of-safety-failings>.



his train that had rolled down a hill, derailed and exploded in the town's downtown core.<sup>142</sup>

It was reported in the *Montreal Gazette* the following day that Montreal-Maine-Atlantic Railway employees told police they feared a catastrophe due to the poor conditions of the company's tracks and equipment and the petroleum products it was carrying. It was reported that when tracks deteriorated, the company ordered lower speed limits, rather than conduct repairs.<sup>143</sup> It was later determined during the investigation that the company tracks had passed Transport Canada inspections. This then raised questions about the proficiency of the inspection program.

There are many tragic individual stories and many heroic stories about that night. No doubt without those who responded and put their own lives on the line to reroute the free flowing oil on the ground or move tanker cars still on the tracks full of oil away from an already ignited tank car, there could have been even more deaths. Even though there was a legal settlement, Lac-Mégantic residents are still trying to rebuild their town, deal with the many aspects of personal loss, and somehow try to recover from the incident. The table below shows other train accidents involving the transportation of tank cars with crude oil.

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<sup>142</sup> CBC News, "Lac-Mégantic Train Disaster: Engineer's Emergency Calls Released," August 21, 2014, accessed April 26, 2015, <http://www.cbc.ca/news/canada/montreal/lac-m%C3%A9gantic-train-disaster-engineer-s-emergency-calls-released-1.2743386>.

<sup>143</sup> *Montreal Gazette*, "Lac-Mégantic Warrant Tells A Disturbing Story," June 17, 2014, accessed March 22, 2015, <http://montrealgazette.com/opinion/editorials/editorial-lac-megantic-warrant-tells-a-disturbing-story>.

Table 6. Train Accidents Involving Transportation of Tank Cars with Crude Oil

Location	Date	# Tank Cars Derailed	# Tank Cars Penetrated	Speed at Derailment Mph	Gallons Crude Oil Lost	Fire
LaSalle, CO	05/14	5	1	9	5,000	No
Lynchburg, VA	04/14	17	2	23	30,000	Yes
Vandergrift PA	02/14	21	4	31	10,000	No
New Augusta, MS	01/14	26	25	45	90,000	No
Casselton, ND	12/13	20	18	42	476,536	Yes
Aliceville, AL	11/13	26	25	39	245,336	Yes

*Source:* U.S. Department of Transportation, Pipeline and Hazardous Administration, “Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains,” accessed June 7, 2015, [http://www.phmsa.dot.gov/pv\\_obj\\_cache/pv\\_obj\\_id\\_75F600DC57D81471F96C328EB5DF9177527E1000/filename/Proposed\\_Rulemaking\\_Enhanced\\_Tank\\_Car\\_Standards\\_and\\_Operational\\_Controls\\_for\\_High\\_Hazard\\_Flamable\\_Trains\\_PHMSA\\_2012\\_0082\\_%28HM\\_251%29\\_RIN\\_2137\\_AE91.pdf](http://www.phmsa.dot.gov/pv_obj_cache/pv_obj_id_75F600DC57D81471F96C328EB5DF9177527E1000/filename/Proposed_Rulemaking_Enhanced_Tank_Car_Standards_and_Operational_Controls_for_High_Hazard_Flamable_Trains_PHMSA_2012_0082_%28HM_251%29_RIN_2137_AE91.pdf).

Another hazard concern is the trains that are transporting Toxic Inhalation Hazard (TIH) materials throughout the United States. There are over 100,000 shipments a year of TIH materials and 90 percent of those include six chemicals—anhydrous ammonia, chlorine, ethylene oxide, anhydrous hydrogen fluoride, sulfur dioxide, and anhydrous hydrogen chloride. Chlorine and anhydrous ammonia are the most frequently transported of all TIH rail shipments. These hazardous materials are used by many industries such as



farming, purifying drinking water, heat and cool homes, medical applications, manufacturing, and mining.<sup>144</sup>

There has been much debate over the transportation of these products and the most effective way to reduce risk. This debate is not without warrant with the accidents that have caused injury and death. The National Counterterrorism Center defines Toxic Industrial Chemicals on their website as:

The term Toxic Industrial Chemicals refers to a variety of chemicals used or created by industry that can have a significant impact on human health if released into the air or water. A potential threat exists for individuals located downwind or downstream from an accidental or intentional release of chemicals or for people situated near toxic industrial processes. Toxic industrial chemicals may pose a risk when they are stored in large quantities in one location. An act of sabotage or an accident can result in a large release of toxic material into the air or water. Some material retains its lethality even after traveling a considerable distance.<sup>145</sup>

Following are two examples of train accidents and derailments that caused tank cars to rupture that led to the escape of TIH materials and loss of life.

An accident occurred on June 28, 2004 near Macdona, Texas. A Union Pacific Railroad (UP) train was traveling westbound on the same mainline track as an eastbound BNSF Railway (BNSF) train. As the BNSF train was entering a parallel siding, the UP strain struck its midpoint. The collision derailed four locomotive units and the first 19 cars of the UP train as well as 17 cars of the BNSF train. As a result of the derailment the 16th car in the UP train, a tank car loaded with liquefied chlorine, was punctured. The chlorine vaporized and engulfed the area surrounding the accident site. Three people, the UP conductor and two local residents, died from the effects of chlorine gas inhalation.<sup>146</sup>

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<sup>144</sup> U.S. Department of Homeland Security, *Transportation Systems Sector-Specific Plan, An Annex to the National Infrastructure Protection Plan 2010*.

<sup>145</sup> National Counterterrorism Center, "Toxic Industrial Chemicals-Mitigation Measures," 2014, accessed May 3, 2015, <http://www.nctc.gov/site/technical/toxic.html>.

<sup>146</sup> National Transportation Safety Board, "NTSB Determines that Crew Fatigue Caused Train collision Near Macdona," July 6, 2006, accessed May 2, 2015,

It was later reported that 60 tons of chlorine was released in three minutes causing the three deaths and 45 persons either treated or admitted to the local hospital.<sup>147</sup> The NTSB went on to report that this accident was the result of human error largely attributed to the Union Pacific (UP) engineer and conductor's lack of sleep. It was also reported that a contributing factor was the conductor's consumption of alcohol on the evening before the accident.<sup>148</sup> The UP conductor was one of the lives lost in the accident.

The second example happened at:

approximately 2:40 a.m. on January 6, 2005, in Graniteville, South Carolina, a train carrying three tanker cars of liquid chlorine under pressure was inadvertently switched onto an industrial spur, where it crashed into a parked locomotive. The train derailed and one of the chlorine tankers was breached, releasing approximately 46 tons of chlorine immediately and an additional 14 tons over the next three days, until a patch could be applied. The incident occurred on the grounds of a textile mill where 183 people were reported to be working the night shift. This resulted in the death of nine people, 72 were hospitalized in nine hospitals, and 525 were examined as outpatients.<sup>149</sup>

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[http://www.nts.gov/news/press-releases/Pages/NTSB\\_Determines\\_that\\_Crew\\_Fatigue\\_Caused\\_train\\_Collision\\_near\\_Macдона\\_Texas.aspx](http://www.nts.gov/news/press-releases/Pages/NTSB_Determines_that_Crew_Fatigue_Caused_train_Collision_near_Macдона_Texas.aspx).

<sup>147</sup> Scott Harris, Ph.D., MSPH, "Macдона, TX Derailment and Chlorine Release" (PowerPoint Presentation, U.S. Air Force Environmental Safety and Occupational Health Conference, Nashville, TN, 2011), accessed May 2, 2015, <http://ahmp.confex.com/ahmp/2013/webprogram/Handout/Session3175/9-17%20830am%20-%20Macдона%20TX%20%20Chlorine%20Derailment>.

<sup>148</sup> National Transportation Safety Board, "NTSB Determines that Crew Fatigue Caused Train collision Near Macдона."

<sup>149</sup> Mary Anne Wenck, David Van Sickle, Daniel Drociuk, Amy Belflower, Claire Youngblood, M. David Whisnant, Richard Tylor, Veleta Rudnick, and James J. Gibson, "Rapid Assessment of Exposure to Chlorine Released from a Train Derailment and Resulting Health Impact," *Public Health Report* 122, no. 6 (November/December 2007): 784-792, accessed May 2, 2015, <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1997246/>.

This was also caused by human error. Both of these examples were the result of human error but this also speaks to the potential of the insider threat. Of the 154 people arrested or killed for plotting terror attacks since September 11, 2001, 77 had United States citizenship.<sup>150</sup>

“A 2003 study by Dr. Jay Boris, a senior scientist at the U.S. Naval Research Laboratory estimated that more than 100,000 people could be killed or injured within the first 30 minutes of a terrorist attack from only one rail car of chlorine passing through a major city such as Washington, D.C. He warned, “Lethally exposed people can die at the rate of 100 per second.”<sup>151</sup> This study is predicated on perfect atmospheric conditions, large mass of people, and other conditions for the worst-case scenario and has been used as a reference article in many TIH studies. Not everyone may agree with this study, but it does cause most to pause and the fact that it could happen leaves it as a possibility to consider during mitigation planning.

One Canadian Pacific Railway official who may agree with this study commented, “Your worst nightmare is sabotage of a train carrying a toxic substance in a

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<sup>150</sup> Jessica Zuckerman, Steven B. Bucci, Ph.D., James J. Carafano, Ph.D, Special Report #137, “60 Terrorist Plots Since 9/11: Continued Lessons in Domestic Counterterrorism” (The Heritage Foundation), chart 3, accessed May 4, 2015, <http://www.heritage.org/research/reports/2013/07/60-terrorist-plots-since-911-continued-lessons-in-domestic-counterterrorism>.

<sup>151</sup> Dr. Jay Boris, U.S. Naval Research Laboratory, presentation to DC City Council, October 6, 2003, quoted in “Railroad and Regional Characteristics” (Railroad Realignment Feasibility Study, National Capital Planning Commission), accessed May 1, 2015, [http://www.ncpc.gov/DocumentDepot/Publications/RailRealignment/FreightRailroadRealignmentStudy\\_Section2B.pdf](http://www.ncpc.gov/DocumentDepot/Publications/RailRealignment/FreightRailroadRealignmentStudy_Section2B.pdf).

heavily populated area. The estimates of the lives and the damage—I don't even want to repeat what it would be.”<sup>152</sup>

All of these examples raise two questions: (1) Why the railroad companies would continue to transport flammable liquids and toxic chemicals at the risk of injury, loss of life, and enormous costs in training, mitigation, clean up, court settlements, and the possibility of a terrorist attack; and (2) What is being done to improve the tank cars themselves and the risk of transporting flammable liquids and toxic chemicals?

A large part of the answer to question one comes from the UP Railroad website that gives insight to that very question.

Union Pacific is a common carrier by rail. Federal law does not allow common carriers by rail to refuse to transport hazmat. Union Pacific does not make TIH materials, own the tank cars the move TIH, load or unload those tank cars or decide the origin or destination to which it is shipped. Federal law requires common carriers by rail to transport TIH. Rail shipment of TIH is the safest option for above-the-ground transport.

Trucks are 16 times more likely than trains to have a hazmat incident.

More than 99.99 percent of rail hazmat shipments reached their destination without a release caused by a train accident, and rail hazmat accident rates are down 91 percent since 1980.

Union Pacific invests heavily in time and money to improve TIH transportation safety, implementing and funding an array of security and safety TIH-related initiatives, and exceeding mandatory TIH-compliance measures. We recognize that rail shipment of TIH is the safest option for above-the-ground transport, and we are continually evaluating and investing in our processes and procedures to ensure that all hazardous materials continue to be handled with the highest level

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<sup>152</sup> Betsy Morris, “Fiery Oil-Train Accidents Raise Railroad Insurance Worries,” *Wall Street Journal*, January 8, 2014, accessed May 8, 2015, <http://www.wsj.com/articles/SB10001424052702304773104579268871635384130>.

of safety and security. We are proud of our excellent safety record and are supportive of proven efforts to enhance safety.<sup>153</sup>

All of the Class 1 railroad companies transport flammable liquids and toxic chemicals within the United States and state that they strive to meet all security and safety requirements.

The answer to question two has been developing in stages and one of those is a mandate released in 2008, requiring the railroad companies to plan the safest possible routes for trains transporting TIH. This has been strengthened with new rules announced on May 1, 2015. At the end of months of speculation and in a final ruling, the Pipeline and Hazardous Materials Safety Administration, in coordination with the DOD released new rules for transporting crude oil by trains. “This final rule addresses comments to the (Notice of Proposed Rulemaking) NPRM and amends the existing hazardous materials regulations (HMR; 49 CFR parts 171-180) pertaining to tank car designs, speed restrictions, braking systems, routing, sampling and classification, and notification requirements related to certain trains transporting large quantities of flammable liquids.”<sup>154</sup>

The overall message is that the new measures will reduce the risks of a catastrophic event and improve rail safety. The combination of tank car derailments, oil spills, and explosions in the U.S and Canada keep this issue in front of the public.

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<sup>153</sup> Union Pacific Railroad, “TIH Facts,” accessed May 1, 2015, [http://www.uprr.com/newsinfo/media\\_kit/safety/tih\\_facts.shtml](http://www.uprr.com/newsinfo/media_kit/safety/tih_facts.shtml).

<sup>154</sup> Federal Railroad Administration, “Summary of Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains, Final Rulemaking,” U.S. Department of Transportation, May 1, 2015, accessed May 3, 2015, [http://www.fra.dot.gov/eLib/details/L16353#p1\\_z5\\_gD](http://www.fra.dot.gov/eLib/details/L16353#p1_z5_gD).

But the rules quickly came under criticism from many sides. Lawmakers and safety advocates said the regulations did not go far enough in protecting the public, while industry representatives said some provisions would be costly and yield few safety benefits. Facing growing pressure from members of Congress as well as local and state officials, the Department of Transportation has taken repeated steps in the last two years to tackle the safety of oil trains and reassure the public. In April of 2015, for example, it set lower speed limits (40 MPH) for oil trains going through urban areas. It also required railroads to provide detailed information about a shipment within 90 minutes of any derailment.<sup>155</sup>

The announcement of the rule changes “focuses on safety improvements that are designed to prevent accidents, mitigate consequences in the event of an accident, and support emergency response.

Unveils a new, enhanced tank car standard and an aggressive, risk-based retrofitting schedule for older tank cars carrying crude oil and ethanol;

Requires a new braking standard for certain trains that will offer a superior level of safety by potentially reducing the severity of an accident, and the “pile-up effect;

Designates new operational protocols for trains transporting large volumes of flammable liquids. The new criteria must consider routing requirements, speed restrictions, and providing contact information for local government agencies.

Provides new sampling and testing requirements to improve classification of energy products placed into transport.<sup>156</sup>

One of those requirements places the responsibility on the railroad company to assess the safest and most secure routes for the transportation of covered hazardous materials using 27 factors listed in 49 CFR 172.820 Appendix D.<sup>157</sup>

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<sup>155</sup> Jad Mouawa, “New Oil Train Rules Are Hit From All Sides,” *New York Times*, May 1, 2015, accessed May 2, 2015, <http://www.nytimes.com/2015/05/02/business/energy-environment/us-sets-new-rules-for-oil-shipments-by-rail.html>.

<sup>156</sup> U.S. Department of Transportation, “DOT Announces Final Rule to Strengthen Safe Transportation of Flammable Liquids by Rail,” May 1, 2015, accessed May 2, 2015, <http://www.dot.gov/briefing-room/final-rule-on-safe-rail-transport-of-flammable-liquids>.

<sup>157</sup> Cornell University Law School, “49 CFR Part 172, Appendix D to Part 172-Rail Risk Analysis Factors,” accessed June 7, 2015, <https://www.law.cornell.edu/cfr/text/49/part-172/appendix-D>.

In 2008, PHMSA, in consultation with FRA, issued the final route analysis rule, 73 FR 72182. That rule, now found at 49 CFR § 172.820, requires rail carriers to select a practicable route posing the least overall safety and security risk to transport security-sensitive hazardous materials. The route analysis final rule requires rail carriers to compile annual data on certain shipments of explosive, PIH, and radioactive materials; use the data to analyze safety and security risks along rail routes where those materials are transported; assess alternative routing options; and make routing decisions based on those assessments. In accordance with § 172.820(e), the carrier must select the route posing the least overall safety and security risk. The carrier must retain in writing all route review and selection decision documentation. Additionally, the rail carrier must identify a point of contact on routing issues involving the movement of covered materials and provide that contact information to the appropriate State, local, and tribal personnel.<sup>158</sup>

Rail carriers must assess available routes and at a minimum use these 27 factors to determine the safest, most secure routes for the transportation of covered hazardous materials. This is found in the Performance of the Safety and Security Risk Analysis required by 49 CFR § 172.820 Appendix D.<sup>159</sup>

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<sup>158</sup> Federal Railroad Administration, “Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains,” May 1, 2015, accessed May 11, 2015, <http://www.fra.dot.gov/eLib/Details/L16354>.

<sup>159</sup> U.S. Government Publishing Office, 49 CFR 172.820, accessed May 11, 2015, <http://www.gpo.gov/fdsys/granule/CFR-2011-title49-vol2/CFR-2011-title49-vol2-sec172-820>.

Table 7. 27 Elements to Determine Safest Route for Transportation of Hazardous Material

Volume of hazardous material transported	Rail traffic density	Trip length for route
Presence and characteristics of railroad facilities	Track type, class, and maintenance schedule	Track grade and curvature
Presence or absence of signals and train control systems along the route (“dark” versus signaled territory)	Presence or absence of wayside hazard detectors	Number and types of grade crossings
Single versus double track territory	Frequency and location of track turnouts	Proximity to iconic targets
Environmentally sensitive or significant areas	Population density along the route	Venues along the route (stations, events, places of congregation)
Emergency response capability along the route	Areas of high consequence along the route, including high-consequence targets	Presence of passenger traffic along route (shared track)
Speed of train operations	Proximity to en-route storage or repair facilities	Known threats, including any threat scenarios provided by the DHS or the DOT for carrier use in the development of the route assessment
Measures in place to address apparent safety and security risks	Availability of practicable alternative routes	Past accidents
Overall times in transit	Training and skill level of crews	Impact on rail network

*Source:* U.S. Department of Transportation, Pipeline and Hazardous Administration, “Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains,” accessed June 7, 2015, [http://www.phmsa.dot.gov/pv\\_obj\\_cache/pv\\_obj\\_id\\_75F600DC57D81471F96C328EB5DF9177527E1000/filename/Proposed\\_Rulemaking\\_Enhanced\\_Tank\\_Car\\_Standards\\_and\\_Operational\\_Controls\\_for\\_High\\_Hazard\\_Flamable\\_Trains\\_PHMSA\\_2012\\_0082\\_%28HM\\_251%29\\_RIN\\_2137\\_AE91.pdf](http://www.phmsa.dot.gov/pv_obj_cache/pv_obj_id_75F600DC57D81471F96C328EB5DF9177527E1000/filename/Proposed_Rulemaking_Enhanced_Tank_Car_Standards_and_Operational_Controls_for_High_Hazard_Flamable_Trains_PHMSA_2012_0082_%28HM_251%29_RIN_2137_AE91.pdf).



After the Lac-Mégantic derailment, the United States DOT issued an Emergency Order requiring all railroads operating trains containing large amounts of Bakken crude oil to notify State Emergency Response Commissions about the operation of these trains through their states.<sup>160</sup> This order seems to attempt to give the railroad companies some flexibility only requiring the release of information on trains containing more than one million gallons of crude oil or about 35 tank cars, but the railroad disagreed. The Association of American Railroads requested a reversal of this order based on the railroads were already providing information at a state level and much of the information can be made public and compromises security and safety. They argued that the information should remain with local, state, and federal emergency responders. The DOD rejected that requests on the grounds it did not meet the definition of Security-sensitive information.<sup>161</sup> This was later reversed in the Final Ruling of 2015 that now only requires the railroads to issue a point of contact with contact information to the emergency managers. “Additionally, the rail carrier must identify a point of contact on routing issues involving the movement of covered materials and provide that contact information to the appropriate State, local, and tribal personnel.”<sup>162</sup>

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<sup>160</sup> U.S. Department of Transportation, “U.S. DOT Takes New Emergency Actions as Part of Comprehensive Strategy to Keep Crude Oil Shipments Safe,” 2014, accessed May 11, 2015, <http://www.dot.gov/briefing-room/us-dot-takes-new-emergency-actions-part-comprehensive-strategy-keep-crude-oil>.

<sup>161</sup> Lisa Riordan Seville, “Railroad Group Urge Withdrawal of Emergency Rule on Oil Train Reporting,” *NBC News*, accessed May 11, 2015, <http://www.nbcnews.com/news/investigations/railroad-groups-urge-withdrawal-emergency-rule-oil-train-reporting-n220351>.

<sup>162</sup> Federal Railroad Administration, “Hazardous Materials: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains.”

With the train derailments causing explosions, toxic chemical leaks, and people dying, city officials and residents have been requesting to know when a train carrying tank cars loaded with flammable liquids or toxic chemicals are transiting their towns in order to be prepared to respond if necessary. This would seem like a logical request but there is also the issue of keeping this schedule information secure in an effort to deter and mitigate any attempts of terrorist attacks.

As discussed earlier in this paper, trains pulling approximately 100 tank cars loaded with flammable liquids and toxic chemicals are a very attractive target for a terrorist, who could use several methods to create a derailment or explosion. An evaluation was performed on all of the major cities in the United States and a list of High Threat Urban Areas was developed that names 46 metropolitan areas (ex. Chicago; Kansas City; Washington, DC; and Fort Lauderdale). In order to reduce the vulnerabilities in these areas, rail carriers are required to develop site-specific security plans that address the security of the transportation in bulk of TIH material in loaded rail cars in High Threat Urban Areas.<sup>163</sup>

In 2015, DHS provided opportunities for nine preparedness grant programs totaling more than \$1.6 billion. The grant programs provide funding to state, local, tribal and territorial governments, as well as transportation authorities, nonprofit organizations, and the private sector, to improve the nation's readiness in preventing, protecting against, responding to, recovering from, and mitigating terrorist attacks, major disasters and other emergencies. The grants focus on the nation's highest risk areas, including urban areas that face the most significant threats. The Urban Area Security Initiative (UASI) will enhance regional preparedness and capabilities by funding 28 (out of 46) high-threat, high-density

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<sup>163</sup> U.S. Department of Homeland Security and U.S. Department of Transportation, "Recommended Security Action items for the Rail Transportation of Toxic Inhalation Hazard Materials," Supplement No. 1, Transportation Security Administration, November 2006, accessed May 11, 2015, [http://www.tsa.gov/sites/default/files/publications/pdf/stakeholders\\_PDF/supplemental\\_no1\\_tihsa.pdf](http://www.tsa.gov/sites/default/files/publications/pdf/stakeholders_PDF/supplemental_no1_tihsa.pdf).

urban areas. This represents Congressional intent to limit FY 2015 UASI funding to those Urban Areas that represent up to 85% of the nationwide risk.<sup>164</sup>

The UASI program is intended to provide financial assistance to address the unique multi-discipline planning, organization, equipment, training, and exercise needs of high-threat, high-density Urban Areas, and to assist these areas in building and sustaining capabilities to prevent, protect against, mitigate, respond to, and recover from threats or acts of terrorism using the Whole Community approach. Activities implemented with UASI funds must support terrorism preparedness by building or enhancing capabilities that relate to the prevention of, protection from, mitigation of, response to or recovery from terrorism in order to be considered eligible.<sup>165</sup>

Two other minor issues that are involved in the conversation of sharing the schedule information and ensuring it remained secure are: (1) the freight train schedules are not as strict as passenger trains, causing some coordination problems; and (2) the railroad companies would like to avoid dealing with environmentalists groups protesting various issues of interest. Both sides have very strong arguments about either releasing or securing the schedule information and probably can find some common ground that would provide the correct level of security and provides the ability for towns to be prepared and respond if necessary. As of the latest ruling, the railroad will only be required to provide point-of-contact information.

Additional key takeaways from these new rules are:

By 2018, the rule would phase out older tank cars, long known to be ill suited for transporting flammable material. A newer generation of cars recently being built, would have to be retired or refitted to meet the new standard by 2020. All cars built under the new standard after Oct. 1, 2015, will have a thicker nine-

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<sup>164</sup> U.S. Department of Homeland Security, Press Office, “DHS Announces Grant Guidance for Fiscal Year 2015 Preparedness Grants.”

<sup>165</sup> U.S. Department of Homeland Security and Federal Emergency Management Agency, “Grant Details: Urban Areas Security Initiative (UASI),” Homeland Security Grants Info, accessed May 23, 2015, <http://www.homelandsecuritygrants.info/GrantDetails.aspx?gid=17162>.

sixteenths-inch tank shell, a one-half-inch shield running the full height of the front and back of a tank car, thermal protection and improved pressure-relief valves and bottom outlet valves. The new rules create a new standard, “high-hazard flammable trains,” defined as “a continuous block of 20 or more tank cars loaded with flammable liquid, or 35 or more tank cars loaded with a flammable liquid dispersed throughout a train.

A provision that requires tank cars to have electronically controlled pneumatic brakes by 2021. The Department of Transportation said the new brakes, known as E.C.P., are more effective than air brakes or dynamic brakes that are currently being used.

Regulators retreated from a provision that would have forced railroads to notify communities of any oil train traffic. Instead, railroads will need to have only a “point of contact” for information related to the routing of hazardous materials. Senators from Oregon said they were disappointed that transportation officials had not expanded public information about oil train routes. “Instead of providing first responders more details about oil shipments, railroads will simply be required to give our firefighters a phone number,”<sup>166</sup>

The new rules redefined the requirement of a High-Hazard Flammable Train (HHFT). A HHFT is now defined as; Based on analysis of the risk of differing train compositions, this rule defines an HHFT as a train comprised of 20 or more loaded tank cars of a Class-3 flammable liquid in a continuous block or 35 or more loaded tank cars of a Class-3 flammable liquid across the entire train. For the purposes of advanced braking systems, this rule also defines a “high-hazard flammable unit train” (HHFUT) as a train comprised of 70 or more loaded tank cars containing Class-3 flammable liquids traveling speeds at greater than 30 mph. The rule ensures that the requirements are closely aligned with the risks posed by the operation of trains that are transporting large quantities of flammable liquids. This rule primarily affects trains transporting large quantities of ethanol and crude oil, because ethanol and crude oil are most frequently transported in high-volume shipments than when transported in a single train, and such trains would meet the definition of an HHFT. By revising the definition of HHFT from that which was proposed in the Notice of Proposed Rule Making (NPRM), we have clarified the scope of the final rule and focused on the highest-risk shipments, while not affecting lower-risk trains that are not transporting similar bulk quantities of Class-3 flammable liquids.

In the August 1, 2014, NPRM, an HHFT was defined, as a train comprised of 20 or more carloads of a Class-3 flammable liquid.

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<sup>166</sup> Mouawad.

This new rule defines an HHFT as a train comprised of 20 or more tank carloads of a Class-3 flammable liquid in a continuous block or 35 tank carloads of a Class-3 flammable liquid across the entire train.<sup>167</sup>

The new rules gained guarded support from one side and dissatisfaction from the other side. Putting extra layers of protection such as reduced speed going through urban areas and increasing the strength of the tank cars from puncture or collapsing under stress, this author feels is a positive step towards the reduction in damage from an accidental or intentional derailment. After the Lac-Mégantic accident that caused the deaths of 47 people, the “railroad voluntarily chose to slow those carrying crude oil and ethanol to 50 miles an hour (now required to reduce to a slower speed). That won’t decrease derailments, says Matthew K. Rose, executive chairman of BNSF Railway Corp., but it will reduce damage if one occurs.”<sup>168</sup>

An example of a train moving at a reduced speed with inferior tank cars derailing and exploding is shown in the following NTSB report in reference to the Mount Carbon derailment. This train was recorded at a speed that meets the new standard and still was involved in a derailment accident.

On February 16, 2015, at 1:15 p.m. eastern standard time, an eastbound CSX crude oil train derailed with 27 loaded tank cars in Mount Carbon, Fayette County, West Virginia. The train consisted of two locomotives followed by a buffer car, 109 tank cars, and a single trailing end buffer car. The train was transporting about 3.1 million gallons of Bakken crude oil, UN1267, Class-3, Packing Group I, from Manitou, North Dakota, destined for the Plains Marketing Terminal in Yorktown, Virginia. Event recorder data indicated that the train was being operated at 33 mph at the time of the accident, below the 50 mph maximum

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<sup>167</sup> Federal Railroad Administration, “Summary of Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains, Final Rulemaking.”

<sup>168</sup> Morris.

authorized speed. At the time of the accident, CSX had a temporary 40 mph speed restriction on the territory due to cold weather.<sup>169</sup>

Concerning the required thermal protection layer, this appears to be a positive step in reducing thermal explosions that happen to tank cars that otherwise survived the accident. These normally are secondary explosions and can continue for many hours after the accident.

Until the Final Ruling on May 1, 2015, neither one of the two main types of tank cars, currently in use, was required to be equipped with thermal protection system that protects the tank from exposure to pool or torch fire conditions that can occur in accidents.<sup>170</sup> Exposing a bare steel, flammable-liquid filled tank care to a large pool fire from product release in an accident can result in tank failure from a thermal tear in the tank that was not otherwise breach in a derailment. The following statement is an example of the same CSX accident and those tank cars involved:

In the CSX Railway derailment in Mount Carbon, WV, the pool fire caused thermal tank shell failures on 13 tank cars that otherwise survived the accident. Emergency responders reported that the first thermal failure occurred about 25 minutes after the accident. By about 65 minutes after the accident, at least four thermal failures with energetic fireball eruptions had occurred. The 13th and last thermal failure occurred more than 10 hours after the accident.<sup>171</sup>

This author has attempted to describe the potential for destruction by an explosion of tank cars loaded with flammable liquid and the lethality of dispersed TIH materials

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<sup>169</sup> National Transportation Safety Board, "Safety Recommendations," April 3, 2015, accessed May 4, 2015, <http://www.nts.gov/safety/safety-recs/recletters/R-15-014-017.pdf>.

<sup>170</sup> U.S. Department of Transportation, "DOT Announces Final Rule to Strengthen Safe Transportation of Flammable Liquids by Rail."

<sup>171</sup> National Transportation Safety Board, "Safety Recommendations."

also loaded in tank cars. There is no doubt that a terrorist from outside of our borders, or the terrorist who poses as an insider threat, knows the potential of these tank cars.

A terrorist would have to accomplish several steps in order to carry out a successful attack on a freight train transporting tank cars. The first step would be locating a freight train that is transporting tank cars with flammable liquids or toxic chemicals. One report argues that because of the complexity of the freight network, over 500 different railroads and 140,000 miles of track, closely guarded schedules and the fluid nature of the scheduling of train movements creates a mathematical challenge of even finding one of these trains carrying TIH products that is very daunting.<sup>172</sup>

This could be a valid point but only for a limited time. It may take some time and effort but someone intent on using a freight train as a weapon will eventually locate their target. In this author's daily 150-mile round trip commute to work, I drive by or over several railroad tracks, and it is not unusual to see a long train transporting tank cars. With terrorists, having the patience to wait for the right opportunity, being adaptable with their methods, and having access to technology, this step could easily be accomplished.

The next step would be the method of attack. The most common method of attack by terrorist is some type of bomb. This could be an Improvised Explosive Device (IED) placed on the tracks in hopes of destroying a large enough portion of the tracks to derail a train. This could be done at nighttime in hopes of not being noticed. With an explosive device, any location would suffice but more damage could be done if strategically located at a bridge or passing through a populated area. Osama bin Laden was plotting an attack

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<sup>172</sup> Toffler Associates, "Creating A secure Future: Addressing the Threat to TIH Rail Cargoes," accessed May 2, 2015, <http://www.toffler.com/assets/1/6/Creating-a-Secure-Future.pdf>.

on United States trains on the 10th anniversary of the 9/11. “The idea according to a joint FBI and Homeland Security bulletin was to tamper with the tracks so that a train would fall off the tracks at a valley or a bridge.”<sup>173</sup>

Of course, our troops in Iraq and Afghanistan are more than familiar with the Vehicle-Borne Improvised Explosive Device (VBIED).

Don’t think that the VBIED, which may sound like typical army jargon, simply describes a car bomb. From the buses that are commandeered into causing mass accidents (Israel) to boat bombs (USS Cole) and even the airliners (9/11) used as WMD’s, the VBIED can come in many forms. As all security professionals know, we should think the unthinkable when it comes to terror in general but especially so with a VBIED.<sup>174</sup>

An example of derailing a train with a vehicle occurred in 2005, in Glendale, California at a railroad crossing.

Juan Manuel Álvarez, a suicidal man who had second thoughts caused a deadly multi-train collision that killed 11 people in Glendale, CA and injured nearly 200, police said,”A deranged individual that was suicidal took a vehicle and maneuvered it . . . onto the tracks. He intended to take his own life, but changed his mind prior to the train striking his vehicle,” Glendale Police Chief Randy Adams said.

Shortly after 6 a.m., a southbound Metrolink commuter train hit Alvarez’s (reported earlier as gasoline soaked) SUV, causing five to seven cars to derail. That train fishtailed, and the bottom cars hit a northbound Metrolink train, which also derailed. An empty, idle Union Pacific train was then hit by one of the commuter cars. There were 35 ambulances and nearly 300 firefighters on the

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<sup>173</sup> FOX News, “Bin Laden Planned to Attack U.S. Trains on 9/11 Anniversary,” May 6, 2011, accessed May 3, 2015, <http://www.foxnews.com/politics/2011/05/05/information-bin-laden-compound-raids-suggests-al-qaeda-trains>.

<sup>174</sup> Henry Morgenstern, “Vehicle Borne Improvised Explosive Device-VBIED, The Terrorist Weapon of Choice,” National Homeland Security Knowledgebase, accessed May 3, 2015, [http://www.nationalhomelandsecurityknowledgebase.com/Research/International\\_Articles/VBIED\\_Terrorist\\_Weapon\\_of\\_Choice.html](http://www.nationalhomelandsecurityknowledgebase.com/Research/International_Articles/VBIED_Terrorist_Weapon_of_Choice.html).



scene from Los Angeles, Pasadena and Ventura counties, sorting through the twisted wreckage and helping to treat passengers.<sup>175</sup>

The driver of the pickup, who was planning on suicide by train, changed his mind and ran from the pickup to save his own life as 11 innocent people lost theirs by his actions. He was later convicted of 11 counts of capital murder and sentence to eleven life sentences without parole.<sup>176</sup> Unbelievably he was acquitted of the train-wrecking charge. February 2015, a decade after the above incident, Jose Alejandro Sanchez-Ramirez abandoned his pickup on the railroad tracks near Oxnard, California and caused a crash and derailment of a commuter train that tragically killed the train engineer (dying a few days later) and injured 30 people.<sup>177</sup> This was very similar to the 2005 Glendale crash described above and Metrolink responded to the Glendale tragedy by investing in new passenger cars that utilizes Crash Energy Management technology. This technology is designed to absorb a crash or a controlled crushing of the car.<sup>178</sup> It more than likely saved lives for this

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<sup>175</sup> FOX News, “11 Killed in Calif. Commuter Train Crash,” January 27, 2005, accessed May 3, 2015, <http://www.foxnews.com/story/2005/01/27/11-killed-in-calif-commuter-train-crash>.

<sup>176</sup> Ann Simmons, “Metrolink Killer Gets 11 Life Terms, no Parole,” *Los Angeles Times*, August 21, 2008, accessed March 30, 2015, <http://articles.latimes.com/2008/aug/21/local/me-metrolink21>.

<sup>177</sup> CBS Los Angeles, “Metrolink Train Derails in Oxnard After Colliding with Truck on Tracks,” February 24, 2015, accessed May 3, 2015, <http://losangeles.cbslocal.com/2015/02/24/metrolink-train-derails-in-oxnard-after-colliding-with-truck-on-tracks>.

<sup>178</sup> Federal Railroad Administration, “Crash Energy Management Project,” U.S. Department of Transportation, accessed May 3, 2015, <http://www.fra.dot.gov/Page/P0315>.

incident. The NTSB released a preliminary report finding the driver made a wrong turn and his vehicle became lodged on the track.<sup>179</sup>

These examples are an attempt to show how a VBIED could be used by a terrorist to attack either freight or passenger trains. The following two statements come from the 2006 Office of Intelligence and Analysis/Directorate for Preparedness Homeland Infrastructure Threat and Risk Analysis Center and the 2011, TSA Office of Intelligence, *Freight Rail Threat Assessment*.

The effective use of IEDs in the majority of attacks against various rail targets worldwide demonstrates the intent, capability, and success of various terrorist groups when attacking passenger rail systems. IEDs will likely remain the preferred method of attack against rail assets because they can be constructed from common materials, contained in inconspicuous bags or packages, and carried or placed without attracting attention. The use of VBIEDs, is another method that can be used to attack rail assets.

The TSA Office of Intelligence, *Freight Rail Threat Assessment* of 2011 was released in 2014. “TSA-OI has no specific, credible intelligence to suggest violent transnational or domestic extremist groups are planning to attack the United States freight rail system, or use the system to facilitate an attack against another target. TSA Office of Intelligence assesses with moderate confidence that the risk of an attack to the United States freight rail industry is low.”<sup>180</sup>

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<sup>179</sup> National Transportation Safety Board, “Preliminary Report, Highway HWY15MH006,” accessed May 3, 2015, [http://www.nts.gov/investigations/AccidentReports/Reports/HWY15MH006\\_preliminary.pdf](http://www.nts.gov/investigations/AccidentReports/Reports/HWY15MH006_preliminary.pdf).

<sup>180</sup> Transportation Security Administration, Office of Intelligence, Transportation Analysis Branch, “(U) Freight Rail Threat Assessment,” February 28, 2011, accessed May 3, 2015, <https://publicintelligence.net/tsa-freight-rail-threats/TSA>.

The above statement is very similar to one made a few months before the attacks on the United States on September 11, 2001:

The 9/11 Commission determined that the FAA had considered the possibility that terrorist would hijack a plane and use it as a weapon. In the spring of 2001, the agency's intelligence function, the Office of Civil Aviation Security, distributed an unclassified CD-ROM presentation to air carriers and airports, including authorities at Logan, Newark, and Dulles. The briefing, whose overall subject was the increased threat to civil aviation, mentioned the possibility of suicide terrorist hijacking but concluded that; fortunately, we have no indication that any group is currently thinking in that direction.<sup>181</sup>

Acknowledging the past can protect you from perils of the future. (Author comments on the FAA and 9/11 are discussed in chapter 5.)

The 2011 TSA Office of Intelligence continues on to “assess with high confidence that passenger trains or stations are more likely to be targeted than freight trains. The interdependency of the freight and passenger rail infrastructure in the United States increases the likelihood that any threats or attacks against passenger rail could impact freight rail as well.”<sup>182</sup>

The TSA said passenger trains and stations were a larger target for such groups rather than freight trains. It added that al-Qaida, its affiliates, and other terrorists motivated by violent extremist views would most likely target the system, using IEDs. Based on disrupted plots, TSA-OI assesses that al-Qaida and its affiliates have demonstrated a continuing desire, intent, and capability to attack mass transit systems in the Homeland and remain the primary terrorist threat to the U.S. transportation industry.<sup>183</sup>

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<sup>181</sup> Priscilla D. Jones, “The First 109 Minutes: 9/11 and the U.S. Air Force” (Paper, Air Force History and Museums Program, Washington, DC, 2011), accessed May 7, 2015, <http://www.afhso.af.mil/shared/media/document/AFD-120905-022.pdf>.

<sup>182</sup> Transportation Security Administration, Office of Intelligence, Transportation Analysis Branch, “(U) Freight Rail Threat Assessment.”

<sup>183</sup> Dibya Sarkar, “Recently Declassified TSA Reports from 2011 Said No Immediate Threats to Freight Rail, Mass Transit,” *Fierce Homeland Security*, October 30,

“Although terrorists worldwide have substantial experience in using vehicle-borne VBIEDs, TSA Office of Intelligence has no evidence of a VBIED ever being used against either a freight or passenger train.”<sup>184</sup>

A statement by the Toffler Associates report says:

experts (although the term experts is not defined) generally agree that the tank car designs are sufficient to withstand the kinds of conditions a terrorist attack might create with the capabilities at their disposal. According to one rail industry hazardous materials officer, explains; A truck next to one of these current tanks cars for example, we’ve done tests, and you can explode a truck next to one of these cars and it’ll just dent it.<sup>185</sup>

This statement does not include the new higher standards tanks cars (DOT-117) that would be even stronger and would seem to support this statement. However, there have been two derailments resulting in ruptures and explosions of the newer industry sponsored tank cars constructed since 2011 (CPC 1232). These derailments were in Lynchburg, Virginia in 2014 and in Mount Carbon, West Virginia in February 2015.<sup>186</sup> Even though these cars will require retrofitting mandated by the May 1, 2015 DOT Final Ruling to meet the new standards this is concerning. With these derailments and the disastrous results such as in Lac-Megantic, this author was unable to find and would like

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2014, accessed May 3, 2015, <http://www.fiercehomelandsecurity.com/story/recently-declassified-tsa-reports-2011-said-no-immediate-threats-freight-ra/2014-10-30>.

<sup>184</sup> Transportation Security Administration, Office of Intelligence, Transportation Analysis Branch, “(U) Freight Rail Threat Assessment.”

<sup>185</sup> Toffler Associates, “Creating A secure Future: Addressing the Threat to TIH Rail Cargoes.”

<sup>186</sup> John Schmitz, “Oil Tankers in Fiery West Virginia Crash were Built with New Safety Features,” *Pittsburg Post-Gazette*, February 17, 2015, accessed May 23, 2015, <http://powersource.post-gazette.com/local/region/2015/02/17/Derailed-CSX-train-in-West-Virginia-hauled-newer-model-tank-cars-oil/stories/201502170171>.

to see studies involving strength test and resistance of tank cars to rupture and explosions. The Toffler statement would only hold true up to a point depending on the type of explosive and the size of the transport vehicle that could deliver varying amounts of explosives. In the case of a VBIED ramming a moving train or quickly pulling up next to a parked train, would be difficult to prevent, but reducing access close to the tracks and monitoring the right-of-ways is a viable practice for the railroad companies to continue improving.

Defending against VBIED's or more likely vehicles without explosives that intend to derail a train is an extremely difficult task in large cities with the numerous railroad crossings. The most effective means of protection against terrorist using a vehicle to intentionally derail a train is to have the trains carrying tank cars slowdown, which they will now be doing, and to know that the crossings are clear.

A technology that is being tested in at least eight states is Intelligent Grade Crossings:

Intelligent Transportation Systems (ITS) for roadways interact with intelligent railway systems at highway -rail intersections (HRIs). Information about train location and arrival times, generated either by a PTC system or track circuits or off-track sensors, will be transmitted from train control centers to highway traffic control centers via the digital data link communications network, to motor vehicle operators, cyclists, and pedestrians via roadside traffic information signs, and to motor vehicle operators also via dedicated short-range communications radios to in-vehicle displays or audio warning systems. Similarly, sensors at HRIs will send information to train control centers and trains over the digital data link communications network should an HRI be blocked by an accidentally or intentionally stalled vehicle. Work on the development of standards for intelligent grade crossings has been started to insure that there will be national interoperability.<sup>187</sup>

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<sup>187</sup> Steven R. Ditmeyer, "Network-Centric Railway Operations Utilizing Intelligent Railway Systems," *Journal of Transportation Law, Logistics and Policy* 77,

This technology has promise for the distant future and does include the action of an intentionally stalled vehicle that probably has the intent of derailing the train or is carrying a type of explosive device. Another way of knowing the crossings are clear is by visual confirmation and this could be accomplished by the use of several of existing technologies. The use of closed circuit television (which is probably being used now for vehicle traffic monitoring) could be used to detect objects on the tracks or crossings that would be seen by those monitoring, who would then communicate a warning to the different users, (metro, Amtrak, and freight) which would give them the extra time and distance to stop if necessary. As the train was passing through the city, they would tune into a discrete radio frequency used for just for this purpose. Aircraft use this same method with air traffic controllers as they fly across the country and around the world. As the train progresses through the city they would be talking with someone who is monitoring each crossing and the communication would be instantaneous if something were to block the crossing, providing the train with the required notice to make an emergency stop. If there were no incidents, the communication could be limited to a simple check-on as they enter the area and a check-off as they leave the area. With this system, there would be eyes on the crossings and it would seem that any engineer would welcome having someone looking ahead and issuing a warning if necessary.

The 2015 wreck in Oxnard, California, is an example of the first indication of an object on the tracks being recognized was when the engineer saw the pickup truck but was unable to stop in time. This is an idea that can be applied to any type of train using

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no. 3 (3rd Quarter 2010): 1-24, accessed May 16, 2015, [www.transportation.northwestern.edu/docs/2011/2011.03.15](http://www.transportation.northwestern.edu/docs/2011/2011.03.15).

the tracks, in any size town or city, and multiple frequencies could be used if necessary depending on the size of the area to be monitored. (This in no way helps in the circumstance of a person who tries to beat the train by disregarding the signals and goes around the crossing arms. This author has actually seen that happen once and it ended badly). This idea could be implemented with minimal equipment and personnel, which would be at a small cost compared to incidents such as the wrecks in Glendale and Oxnard. If it works for air traffic control all over the world, it could possibly work in this industry.

The chart below provides the breakdown of Collisions-Fatalities-Injures of train-car incidents at public and private crossings and emphasizes the significance of improving existing safety practices or the need to implement a new type of technology or concept.

Table 8. Highway-Rail Incidents at Public and Private Crossings, United States, 2000-2014

<b>Year</b>	<b>Collisions</b>	<b>Fatalities</b>	<b>Injuries</b>
2000	3,502	425	1,219
2001	3,237	421	1,157
2002	3,077	357	999
2003	2,977	334	1,035
2004	3,077	372	1,092
2005	3,057	359	1,051
2006	2,936	369	1,070
2007	2,776	339	1,062
2008	2,249	290	992
2009	1,934	249	743
2010	2,051	260	887
2011	2,061	250	1,045
2012	1,985	230	975
2013	2,096	231	972
2014	2,280	267	832
<b>Totals</b>	<b>49,191</b>	<b>4,753</b>	<b>15,131</b>

*Source:* Created by author using Operation Lifesaver, “Crossing Collisions and Casualties By Year,” March 12, 2015, accessed May 7, 2015, <http://oli.org/about-us/news/collisions-casulties>.

These statistics show an average of 3,300 collisions between a train and a vehicle annually at railroad crossings. As an example, if a system were developed such as the one suggested above that reduced the collisions by 20 percent there would be on average 660 fewer collisions, 63 fewer fatalities, and 200 fewer injuries annually. This would also be a deterrent and mitigating factor that would reduce the risk of a terrorist using a VBIED to attack a passenger train full of riders, or a train freight train carrying tank cars loaded with crude oil or toxic chemicals, causing derailment and mass casualties.

The last two weapons this paper will discuss that could be used to attack trains carrying tank cars are a large caliber gun and a shoulder launched rocket or rocket-



propelled grenade (RPG). The new enhanced standards for new and existing tank cars used in High Hazard Flammable Trains (HHFT) were announced in 2014 but were made official in May of 2015. There has been a timeline established for the retrofitting of affected tank cars that will meet the standard of the new tank cars. The construction of the new tank car (DOT-117) will have:

Tank shell thickness of 9/16 (.6204) inch of TC-128 grade B normalized steel.

Layer of thermal protection

Tank jacket is to be minimum 11-guage (11-guage is less than 1/8 inch)

Full height 1/2-inch thick head shield (head shields are on both ends)<sup>188</sup>

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<sup>188</sup> U.S. Department of Transportation, “Rule Summary: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains,” Transportation.gov, accessed May 3, 2015, <http://www.transportation.gov/mission/safety/rail-rule-summary>.

## DOT 117 Specification Car

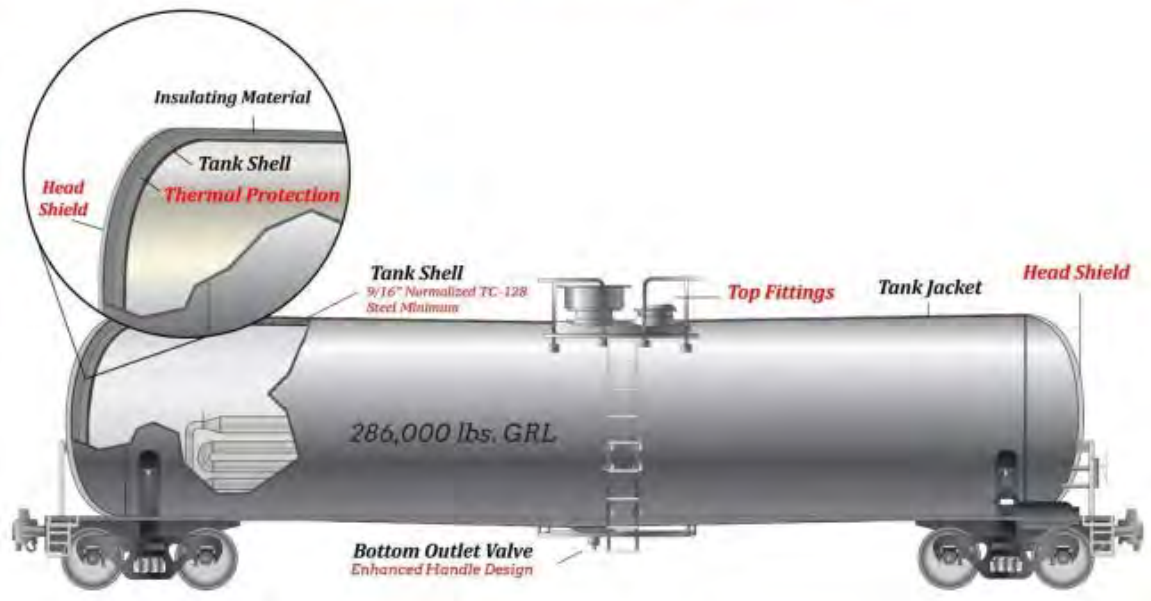


Figure 4. DOT 117 Specification Car

*Source:* U.S. Department of Transportation, “Rule Summary: Enhanced Tank Car Standards and Operational Controls for High-Hazard Flammable Trains,” Transportation.gov, accessed May 3, 2015, <http://www.transportation.gov/mission/safety/rail-rule-summary>.

This construction is not intended to stop a high caliber gun using metal piercing incendiary ammunition or an RPG. The new tank-car shell thickness requirement is 9/16 inch and would be able to withstand many of the available weapons and ammunition, but not all of them. This author was able to find a demonstration of a .50 caliber rifle using armor piercing incendiary rounds, shooting at a 1/2-inch steel plate at 100 yards.<sup>189</sup> The round easily went through the 1/2-inch steel plate and caused a fiery explosion on

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<sup>189</sup> Miculek.com, “50 cal Armor Piercing Incendiary Rounds Slow Mo!” YouTube, March 20, 2014, accessed April 5, 2015, <https://www.youtube.com/watch?v=zKRYJCOuHc0>.

contact. The thickness of the steel plate used in the demonstration was not the same thickness as the steel used on the new tank cars but the difference is only 1/16 inch. There is no way for this author to determine the extent the thermal protection on the tank car might help in this circumstance.

The results of the shoulder launch rocket or rocket-propelled grenades would be devastating in an attack on a tank car that is loaded with a flammable liquid or a toxic chemical. There is no expectation of the railroad companies being able to defend against something of this magnitude. These weapons are described as anti-tank, are highly portable, relatively low cost, and are fairly simple to use.<sup>190</sup> Those three characteristics, portable, low cost, and simple to use describe weapons that are dangerous in the hands of those who have ill intent against our country because it would open it up to smaller groups who are less organized and financed. The positive side is the extreme difficulty in obtaining a weapon such as the rocket-propelled grenades in the United States, but there have been arrest for these very weapons.

In 2009 in New York, two men were sentenced “to 20 years in prison for plotting to smuggle shoulder-fired surface-to-air missiles (‘SAMs’), rocket-propelled grenades (‘RPGs’), anti-tank guided missiles, and other high-powered military weapons into the United States for sale.”<sup>191</sup> However, just as the statement below explains, we cannot fail to consider all the possibilities.

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<sup>190</sup> Business Insider, “As ISIS Continues to Gain Ground, Here’s What the Militants Have in Their Arsenal, RPG-7’s,” accessed May 4, 2015, <http://www.businessinsider.com/isis-military-equipment-arsenal-2014-11#rpg-7s-14>.

<sup>191</sup> Federal Bureau of Investigation, “Arms Trafficker Sentenced to 20 Years in Prison for Plot to Smuggle Shoulder-Fired Surface-to-Air Missiles, Rocket-Propelled

At 2:50 p.m. on April 15, 2013, two explosions went off at the finish line of the Boston Marathon. The brazen terrorist attack killed three people, injured and maimed hundreds more, and shocked the nation. Despite being long recognized as a potential threat by law enforcement and intelligence, few Americans had considered the use of an improvised explosive device (IED) on American soil. Due to only a few, and relatively small, attacks since 9/11, the public was in a state of unawareness.

Yet, the fact remains that there have been at least 60 Islamist-inspired terrorist plots against the homeland since 9/11, illustrating the continued threat of terrorism against the United States. Fifty-three of these plots were thwarted long before the public was ever in danger, due in large part to the concerted efforts of U.S. law enforcement and intelligence.

The Heritage Foundation has tracked the foiled terrorist plots against the United States since 9/11 in an effort to study the evolving nature of the threat and garner lessons learned. The best way to protect the United States from the continued threat of terrorism is to ensure a strong and capable domestic counterterrorism enterprise—and to understand the continuing nature of the terror threat.<sup>192</sup>

The Boston Marathon bombing After Action Report was over-all positive in the emergency response to the incident and brought out the fact that an exercise had previously been performed that included the detonation of explosives.<sup>193</sup> As indicated above in the chilling statement referring to 60 plots against our homeland, there is little doubt that number will continue to grow. All of us depend on the many agencies that plan, prepare, and work 24/7 to prevent weapons such as the RPG from entering our homeland and ending up in the hands of a terrorist.

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Grenades, and Other Military Weapons,” April 16, 2009, accessed May 4, 2015, <http://www.fbi.gov/newyork/press-releases/2009/nyfo041609a.htm>.

<sup>192</sup> Zuckerman, Bucci, and Carafano.

<sup>193</sup> After Action Report for the Response to the 2013 Boston Marathon Bombings, December 2014, accessed May 4, 2015, <http://www.mass.gov/eopss/docs/mema/after-action-report-for-the-response-to-the-2013-boston-marathon-bombings.pdf>.

## Cyber-Attacks

New technologies bring great benefits and advances to the railroad systems and are designed to provide updates on train positions, track conditions, produce faster and more dependable communications, and other operational information. The end result of these improvements are that they rely more on wireless communication resulting in the network and trains no longer functioning as a closed system, that leads to vulnerabilities and threats.<sup>194</sup>

One other method for a terrorist attack that could have a great impact on passenger, freight and the economy is a cyber-attack. Even terrorist from small under developed countries have progressively gained interest and access to new computer technology and are attempting to position themselves to exploit this new type of weapon through cyber-attacks. Although all industries are vulnerable and are continually layering protection and updating as much as possible, “policymakers and cybersecurity experts contend that energy is the most vulnerable industry; a large-scale attack could temporarily halt the supply of water, electricity, and gas, hinder transportation and communication, and cripple financial institutions.”<sup>195</sup>

In March 2013, Director of National Intelligence James Clapper identified cyberattacks as the greatest threat to U.S. national security. Critical infrastructure—the physical and virtual assets, systems, and networks vital to national and economic security, health, and safety—is vulnerable to cyberattacks

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<sup>194</sup> U.S. Department of Homeland Security, *Roadmap to Secure Control Systems in the Transportation Sector*, August 2012, accessed May 8, 2015, <https://ics-cert.us-cert.gov/sites/default/files/ICSJWG-Archive/TransportationRoadmap20120831.pdf>.

<sup>195</sup> Global Conflict Tracker, “Cyber-attack on U.S. Infrastructure,” *Council on Foreign Relations*, accessed May 4, 2015, <http://www.cfr.org/global/global-conflict-tracker/p32137#/?marker=2>.

by foreign governments, criminal entities, and lone actors. The Whitehouse requested a 20 percent increase in the 2014 budget for cybersecurity and also established the new Cyber Threat Initiative Integration Center but then failed to address the gaps in policymaking that leaves vulnerabilities unaddressed.<sup>196</sup>

A new massive multi-billion dollar train control system to prevent train accidents, with innovative technology that was not even developed when mandated by Congress, that will be a system of systems, will drastically increase the need for cyber-attack protection in the freight rail industry. Positive train control (PTC) is a new set of highly advanced technologies designed to automatically stop or slow a train before certain types of accidents occur, is scheduled for completion in December of 2015. PTC is required to be installed and implemented on Class I railroad main lines over which any poisonous- or TIH hazardous materials are transported; and, on any railroad's main lines over which regularly scheduled passenger intercity or commuter operations are conducted. It is currently estimated this will equate to approximately 70,000 miles of track of the 160,000 available across the United States. Specifically, PTC, as mandated by Congress in the Rail Safety Improvement Act of 2008 must be designed to prevent:

Train-to-train collisions

Derailments caused by excessive speed

Unauthorized incursions by trains onto sections of track where maintenance activities are being preformed

Movement of a train through a track switch left in the wrong position.<sup>197</sup>

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<sup>196</sup> Ibid.

<sup>197</sup> Federal Railroad Administration, "Positive Train Control (PTC) Information Railroad Safety," U.S. Department of Transportation, accessed May 5, 2015, <https://www.fra.dot.gov/Page/P0358>.

This responsibility of this new system was placed solely on the freight railroads to develop and finance, and has already cost \$5 billion and will require more than \$9 billion before development and installation is complete.<sup>198</sup> Although the completion deadline is December 31, 2015, three of the four Class I railroads say they will not be ready until 2017 or later. The DOD released a report recommending extending the deadline, and other measures supporting PTC.<sup>199</sup>

PTC will also apply to Amtrak trains. The recent derailment of an Amtrak train in Philadelphia on May 14, 2015, was attributed to the train's attempt to go through a curve at an excessive speed of 106 miles per hour in a 50 miles per hour speed zone. This immediately renewed calls for an automatic braking system, which is the purpose of the PTC system.<sup>200</sup>

The system and one of its subcomponents, Advanced Civil Speed Enforcement (ACSES) are designed to automatically stop a train before certain potential incidents caused by human error occur, including train-to-train collisions, derailments caused by excessive speed or train movements through misaligned switches, and work zone mishaps. For example, when an unsafe movement occurs, the ACSES audibly alerts the locomotive engineer and displays a safe braking distance based on the train's speed, length, width and weight, and the grade and curve of the track. If the locomotive engineer does not respond to

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<sup>198</sup> Association of American Railroads, "Positive Train Control," accessed May 4, 2015, <https://www.aar.org/policy/positive-train-control>.

<sup>199</sup> Mischa Wanek-Libman, "GAO Issues PTC Report, Urges Flexibility with Implementation," *RT&S*, September 17, 2013, accessed May 4, 2015, <http://www.rtands.com/index.php/cs/gao-issues-ptc-report-urges-flexibility-with-implementation.html>.

<sup>200</sup> Bart Jansen, "Automatic Braking Long a Priority for Trains, but Costs are Daunting," *USA Today*, May 15, 2015, accessed May 20, 2015, <http://www.usatoday.com/story/news/2015/05/14/automatic-braking-amtrak-crash-positive-train-control-ntsb-congress/27300969/>.

the audible warning and screen display, the onboard computer will activate the brakes and safely bring the train to a stop.<sup>201</sup>

The system works by units placed alongside the tracks monitoring the train's speed, location, and track conditions.<sup>202</sup>

The National Transportation Safety Board has urged adoption of positive train control as one of its "most wanted" safety recommendations since 1990. The urgency was revived in December 2013 with a Metro-North crash that killed four in New York, and with this Amtrak crash, which killed eight. A National Transportation Safety Board official stated, "The cause of the Amtrak crash is still under investigation. But with the train going 106 mph into a curve with a 50-mph speed limit, the automatic brakes would have prevented the crash." The same official later stated, "The cause of the Amtrak crash is still under investigation, and positive train control is installed throughout the Northeast, but not yet along that section of track where the accident occurred."<sup>203</sup>

The four main requirements that PTC was designed to prevent, and are listed on the previous page will need protection from cyber-attacks with cutting-edge technology, innovative software, and IT specialist. There have been at least two confirmed instances of a cyber-attack causing physical damage of equipment. The first is the well know Stuxnet virus that the United States and Israel employed against control systems in Iran that destroyed centrifuges at a uranium enrichment plant. Another report in December of 2014 came from the German Federal Office for Information Security. A cyber-attack that gained access through spear phishing or emails targeting particular individuals that would trick people into opening messages that would steal login names and passwords. This information allowed them to gain access to the plant's office network and then its

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<sup>201</sup> Amtrak, "Positive Train Control: Moving Ahead Safely," *Amtrak ink* 20, no. 1 (January-February 2015): 14, accessed May 20, 2015, <http://www.amtrak.com/ccurl/774/37/Amtrak-Ink-Jan-Feb-2015.pdf>.

<sup>202</sup> Jansen.

<sup>203</sup> Ibid.



production system. Once the hackers were in the system they began to create multiple failures on single components or complete control systems. Eventually the plant was unable to shut down a blast furnace in a controlled manner and caused massive damage to the system.<sup>204</sup>

In 2011, the well-known group Anonymous hacked into Bay Area Rapid Transit's (serves the San Francisco-Oakland area), websites twice in one week. Anonymous hackers broke into a website and gained access to names, phone numbers, email addresses, and passwords of more than 2,000 riders. Next, they broke into another BART-related site and posted on a separate website the names, home and email addresses of more than 100 BART police officers.<sup>205</sup>

In 2007, a 14-year-old Polish teenager in the city of Lodz, Poland, studied the tram and track operations in his city and built a device similar to a TV remote control to change switch points on the tracks. Four trams were derailed and others had to make emergency stops sending twelve people to the hospital with injuries. Problems with the signaling system on Lodz's tram network became apparent when a driver attempting to steer his vehicle to the right was involuntarily taken to the left. As a result, the rear car of

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<sup>204</sup> BBC News, "Hack Attack Causes 'Massive Damage' at Steel Works," December 22, 2014, accessed May 5, 2015, <http://www.bbc.com/news/technology-30575104>.

<sup>205</sup> Julie Sneider, "Railroads Gear up to Protect Computers from Hackers," *Progressive Railroading*, September 2012, accessed May 4, 2015, [www.progressiverailroading.com/c\\_s/article/Railroads-gear-up-to-protect-computers-from-hackers--32354](http://www.progressiverailroading.com/c_s/article/Railroads-gear-up-to-protect-computers-from-hackers--32354).

the tram jumped the rails and collided with another passing tram. Transport staff immediately suspected outside interference.<sup>206</sup>

UP, the largest freight railroad company in the United States houses their primary dispatching facility, Harriman Dispatching Center, in Omaha, Nebraska. It is linked to regional dispatching and locomotive management facilities at various locations along our network. The Harriman Dispatching Center coordinates moves of locomotives and trains, manages traffic and train crews on their network, and coordinates interchanges with other railroads. Disruption of operations due to a cyber-attack, could cause massive delays and create a ripple effect throughout their customer base with the effects dependent on the length of the problem. In preparation for a cyber-attack or any other major event such as weather, UP maintains the capability to conduct critical operations at back-up facilities in different locations.<sup>207</sup>

As with UP, so are all railroad companies concerned about cyber-attacks and are placing their resources and efforts into cyber-security. Cyber-attacks are a danger that the White House and Director of National Intelligence feel is one of the greatest threats to our national security. Being part of the critical infrastructure brings unwanted attention and great responsibility to deter and stop anyone from using the rail system as a weapon to cause physical damage or damage to the United States economy.

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<sup>206</sup> John Leyden, "Polish Teen Derails Tram after Hacking Train Network," *The Register*, January 11, 2008, accessed May 5, 2015, [http://www.theregister.co.uk/2008/01/11/tram\\_hack](http://www.theregister.co.uk/2008/01/11/tram_hack).

<sup>207</sup> Edgar Online Inc., "Item 2. Properties," accessed May 4, 2015, <http://sec.edgar-online.com/union-pacific-corp/10-k-annual-report/2013/02/08/section7.aspx>.

Most everything discussed above would be considered a major event that could disrupt the flow of goods and services and possibly affect the economy of the United States. Consider if someone were to hack into one or several of the Class I freight company's maintenance manuals and just change the tech orders that would cause a service tech to improperly repair a major system in a locomotive. What if several or many of the improper repairs were made and what would have to occur before it was determined what happened? This author feels that the greatest threat to the passenger and freight rail systems is a cyber-attack. With the resilience of the railroad system to reroute and collaborate with other companies, as was displayed in the hurricanes that destroyed many miles of track and bridges, this would typically only cause a temporary reduction in service. However, a cyber-attack that could create multiple failures on individual components or failures on complete control systems causing the railroad infrastructure to malfunction or stop, could cause major disruptions in service for a long period of time. Could a cyber-attack cause trains to simply slow down or come to a complete stop, or is it possible that an attack could cause collisions? Unfortunately, the cyber-attack could be on another part of the critical infrastructure and have a major second and third order affect. If the energy sector were to be attacked causing an outage of the power grid, this would affect the power, fuel, and control portions of the railroad system. What hurricanes and flooding cannot accomplish, a well-placed terrorist cyber-attack can change the transportation world in a moment of time. If our passenger (including transit) and freight transportation systems come to a stop, then the waterfall effect begins.

### Global Comparison

Many ways could be used to compare the United States railroad system to other countries railroad systems. This paper developed questions and retrieved facts that are presented in four tables to compare and display the similarities and differences of five countries railroad systems to the United States. The five countries selected for comparison are China, France, India, Russia, and Canada.

Table 9 reflects the results of 10 categories or areas studied that are listed below. Those areas attempt to show different influences and facts of each country to determine an overarching picture of each country's railroad system. Of the 10 questions listed below, applied to each country, the data for the first four questions are only displayed in table 9 with questions 5-9 being addressed individually in more detail below and the data populated in Table 8.

1. Form of government.
2. How many miles of railroad are there in the country?
3. Data depicting the total number of locomotives of passenger and freight, freight cars, and passenger cars.
4. Data depicts the annual passengers per year.
5. Is the private railroad system government or privately owned?
6. Is the freight railroad system government or privately owned?
7. Does the passenger railroad system have a dedicated protection force?
8. Does the freight railroad system have a dedicated protection force?

9. Is the railway system an economic benefit to the country and would a major disruption in service of the freight or passenger railroad systems have a negative impact on the country's economy?

Table 2 reflects the number of terrorist attacks on the railroad system from 2008-2014 Table 3 reflects the GTI rankings for the six selected countries for 2012 and 2014. Table 4 reflects the GTI rankings for the top five countries with the highest incidents and most affected by terrorist attacks.

Questions 5-6: Are the passenger and freight systems private or Government owned? The passenger rail in the United States is Amtrak, which is not a government agency, but a government owned for-profit corporation that operates intercity passenger rail services in 46 states and the District of Columbia. Amtrak was created by Congress in the Rail Passenger Service Act of 1970 and assumed the common carrier obligations of the private railroads in exchange for the right to priority access of their tracks for incremental cost.<sup>208</sup>

The United States freight rail network consists of 140,000 miles of track, which are operated and maintained by more than 570 privately owned freight railroad companies. The largest are the seven Class I railroads that account for 90 percent of employees and 94 percent of revenue. The remainders are Non-Class I railroads, also known as regional (21) and short line railroads (540).<sup>209</sup>

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<sup>208</sup> U.S. Department of Transportation, Federal Railroad Administration, "Amtrak Overview," accessed January 2, 2015, <https://www.fra.dot.gov/Page/P0052/>.

<sup>209</sup> Association of American Railroads, "Overview of America's Freight Railroads."

China Railway Corporation is the state-owned national railroad operator in China and manages all commuter rail and freight transport. Until 2013, the Ministry of Railways was a powerful agency but was dismantled because of criticism of monopolizing the railroad and of corruption.<sup>210</sup> China Railway provides service through several small companies in multiple provinces and regions. With 5,700 train stations, they support the largest population in the world. Its website books 4.5 million tickets per day, based on 20 million (includes commuter) daily users.<sup>211</sup> China is investing heavily in both passenger and freight rail systems. The China Railway Corporation was created in 2013 as it took over the assets and debts from the former Ministry of Railways that was dissolved. Already possessing the largest high-speed rail network in the world, they plan to connect all of their cities that have populations over 500,000. China is also planning a \$250 billion rail link with Moscow that will reduce travel time to only 48 hours between Moscow and Beijing. This is supported by car manufacturers and other Chinese industries as this will provide an alternative to shipping via the ocean routes, which can take up to two months from inland China.<sup>212</sup>

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<sup>210</sup> Library of Congress, "China: Ministry of Railways Dismantled," April 4, 2013, accessed May 11, 2015, [http://www.loc.gov/lawweb/servlet/lloc\\_news?disp3\\_l205403536\\_text](http://www.loc.gov/lawweb/servlet/lloc_news?disp3_l205403536_text).

<sup>211</sup> Jiansheng Zhu, Ph.D., "China Railway Corporation," accessed May 12, 2015, <http://pivotal.io/big-data/case-study/scaling-online-sales-for-the-largest-railway-in-the-world-china-railway-corporation>.

<sup>212</sup> Nicholas Choa, "Building a High-Speed Silk Road," *U.S. News and World Report*, April 14, 2015, accessed May 6, 2015, [www.usnews.com/opinion/blogs/world-report/2015/04/14/asian-infrastructure-investment-bank-and-china-rail-network-worth-watching](http://www.usnews.com/opinion/blogs/world-report/2015/04/14/asian-infrastructure-investment-bank-and-china-rail-network-worth-watching).

Russian Railways is entirely state-owned and has a monopoly on passenger and cargo transportation within Russia. The company carries nearly 1.3 billion passengers and 1.3 billion tonnes of freight annually. The Russian rail network provides services to most major cities and has a direct impact on growth, industrial development, and regional integration. Russian Railways is a 100 percent state-owned rail monopoly with 987 enterprises and 165 subsidiaries. In addition, with 1.2 million employees, it is the biggest employer in the country and one of the world's leading freight carriers.<sup>213</sup> Having a state-owned freight railroad resulted in poor management, poor service, and a heavy debt that led to a call for limited privatization. Having a major impact on the Russian freight system, was the decision over the last decade, for Russian Railways to divest itself of a portion of the freight industry allowing privatization and competition while maintaining control of the track and locomotives. A majority of the rail cars (reported number of cars vary from 600,000-1 million) are now operated by privately owned transport companies.

In 2013, Russia approved a \$17 billion investment in the Trans-Siberian Railway expansion of approximately 5,800 miles. This project is intended to increase exports of Russian commodities and improve Russia's role in facilitating overland trade between Europe and Asia.<sup>214</sup> Comparatively in 2014 alone, the United States freight companies invested \$28 billion into the infrastructure.<sup>215</sup> The high share of rail in the Russian freight

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<sup>213</sup> PIO Russian Railways, "Overview," accessed May 12, 2015, [http://eng.rzd.ru/dbmm/download?vp=49&load=y&col\\_id=121&id=12322](http://eng.rzd.ru/dbmm/download?vp=49&load=y&col_id=121&id=12322).

<sup>214</sup> Stratfor Global Intelligence, "Russia's Railway Expansion and Asia-Europe Trade," August 6, 2013, accessed May 6, 2015, <https://www.stratfor.com/analysis/russias-railway-expansion-and-asia-europe-trade>.

<sup>215</sup> Association of American Railroads, "Overview of America's Freight Railroads."

transportation market is driven by the country's geography, the economic importance of commodity production and heavy industry in Russia as well as by the limitations of other transportation networks. Because of the country's huge territory and vast natural resources, a highly developed railroad system is vital to Russia and is the key transportation mode in Russia with over 85 percent of the total volume.<sup>216</sup>

In Canada, nation-wide passenger services are provided by the federal crown (state-owned) corporation Via Rail. Via Rail is similar to Amtrak and runs on 7800 miles of track, 500 trains per week, carries four million passengers annually, and operates with 80 locomotives and 400 cars. Where Via Rail has routes with destinations to New York City, Seattle, Chicago, Buffalo, Albany, and Detroit, Amtrak also has routes and destinations into Canada's cities of Toronto, Vancouver, and Montreal.<sup>217</sup> Canada has a large and well-developed railroad of approximately 32,300 miles and a market that today transports primarily freight. There are two major publicly traded freight railway companies, the Canadian Pacific Railway and Canadian National. Canadian National is the larger of the two and both run routes into the United States.

Indian Railways is state-owned enterprise, owned and operated by the Government of India. The Prime Minister of India has recently made efforts to upgrade a debilitated system. With a system that moves eight billion people a year there will need to be a complete overhaul not only in the infrastructure but in the overall management of both passenger and freight rail. India's 2015 railway budget revealed a substantial \$137

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<sup>216</sup> Globaltrans, "Industry Overview," May 6, 2015, accessed May 7, 2015, <http://www.globaltrans.com/investors/rail-industry-market/industry-overview/>.

<sup>217</sup> Via Rail Canada, "Destinations," accessed May 12, 2015, <http://www.viarail.ca/en/explore-our-destinations/trains>.



billion boost in funding over the next five years to update and improve the countries aging but extensive rail network.<sup>218</sup>

France owns the railroad company, French National Railway Company which operates the country's national rail services, including the high-speed network. It's services include operation of both passenger and freight. Because of a European Union Directive, the French government was required to separate train operations from the railway infrastructure. The French Rail Network owns and maintains the French national railway network and the trains are operated by French National Railway Company. After 30 years, the Government owned High Speed trains are having financial difficulties. Forty percent of the trains still travel on conventional track rather than the specially built high-speed lines, which slows them down and creates more frequent stops. France's Audit Office blamed local authorities for pressuring the state to allow the High Speed trains to pass through their towns for economic reasons, but is creating an incoherent network.<sup>219</sup>

Question 7: Does the passenger rail system have a dedicated protection force? The United States passenger rail provider Amtrak has a national police force of more than 500 personnel at more than 30 locations in 46 states. The APD provides protection at the stations and on the trains. The APD is comprised of the Patrol officers and Special

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<sup>218</sup> Ankit Panda, "India Reveals Ambitious Railway Improvement Plans," *The Diplomat*, February 26, 2015, accessed May 7, 2015, <http://thediplomat.com/2015/02/india-reveals-ambitious-railway-improvement-plans/>.

<sup>219</sup> Ray Massey, "Stuck in the Slow Land: 40 Percent of France's TGV Trains Still Run on Regular Tracks," *Daily Mail*, October 2014, accessed May 10, 2015, <http://www.dailymail.co.uk/news/article-2810110/Stuck-slow-lane-40-cent-France-s-renowned-high-speed-TGV-trains-run-regular-tracks-damning-report-says.html>.

Operations Division that includes a K-9 unit, Special Operations Unit and Intelligence and Counter-Terrorism Unit.<sup>220</sup>

Russian Railways also employs private security personnel, as well as the federal Transport Police that protect railway stations. With the many terrorist attacks in Russia, the federal police agency and the military support all areas of transportation. In July of 2014, inspection systems were installed in 34 stations to screen passengers and baggage. Rail personnel also are being trained how to respond to emergency situations, and closed circuit television has been installed in many stations, sending images to police and other law enforcement. Russia has experienced terrorist attacks on their passenger rail with the more recent attack coming in 2013. The suicide attack occurred in the Volgograd 1 Station in city of Volgograd in Southern Russia. The terrorist attack killed 18 people and injured 44 others. The bomb used in the attack, contained 22 pounds of TNT, was rigged with shrapnel, and was detonated near the metal detectors at the station entrance.<sup>221</sup> There have also been attacks on other modes of transportation that requires Russia to maintain a status of high alert.

Canada relies on the Canadian Pacific Police Service to protect all security aspects of the railroad network. Railroad police are unique in Canada as they are essentially a private company and have jurisdiction in any place within 500 meters of property that the railroad company owns, possesses, or administers. In the United States,

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<sup>220</sup> Amtrak Police Department, “Amtrak Police Department,” accessed February 7, 2015, <https://police.amtrak.com/>.

<sup>221</sup> BBC News, “Suicide Bomber Hits Russia’s Volgograd Train Station,” December 29, 2015, accessed May 10, 2015, <http://www.bbc.com/news/world-europe-25541019>.

the Canadian Pacific Police Service members are fully commissioned police officers within the State in which they operate, empowered by that State to enforce the law. The extent to which railway police officers may exercise law enforcement authority and definition of jurisdiction varies by State.<sup>222</sup>

In support of the Canadian Pacific Police service and probably in response to the foiled terrorist plot to derail a Via Rail train, Via Rail Canada established the new Via Rail Police Service. This represents the first time a Canadian railroad company has achieved police services status under the Railway Safety Act since Canadian Rail established their police service in 1923. Via Rail Police Service is not an armed policing service, and they only conducting mandated or corporate sanctioned investigations support activities. It is not intended to conduct law enforcement activities, but will assist police of jurisdiction in the collection of evidentiary information.<sup>223</sup>

The National Police Agency of the Republic of China supplies all of the police forces at every level nationally and includes all areas of transportation. China has had several violent attacks against the passenger railroad industry. In an organized terrorist attack, attackers (five to six) dressed in black clothing killed 33 and injured 130 in a mass stabbing at a Chinese train station.<sup>224</sup>

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<sup>222</sup> CP, “CP Police Service,” accessed May 10, 2015, <http://www.cpr.ca/en/safety/cp-police-service>.

<sup>223</sup> Via Rail Canada, “Rail Policing Security,” accessed May 14, 2015, <http://www.viarail.ca/en/travel-information/security>.

<sup>224</sup> Stephen McDonnell, “China Train Station Attack: 33 Killed in Mass Stabbing in Yunnan Province,” *ABC News*, March 2, 2014, accessed May 12, 2015, <http://www.abc.net.au/news/2014-03-02/33-killed-in-mass-stabbing-at-china-train-station/5293220>.

Three people were killed and 79 injured in a bomb and knife attack at a railway station in the Xinjiang region. Verifying reports from this region is difficult because the flow of information out of Xinjiang is tightly controlled. It was reported that the explosion appeared to be centered around luggage left on the ground between a station exit and a bus stop. In this region, authorities have vowed to deploy a strike-first approach against terrorist.<sup>225</sup> This research paper found two credible reports of attacks on the railroad system. However, numerous media reports of the inability to document accurate information on terrorist attacks due to the censorship practices of the Chinese Government causes the overall data for China that was to be used in table 9 to be unreliable.

“In the Indian system of policing of Railways, there are two agencies working side by side. The Government Railway Police (GRP) is responsible for the maintenance of law and order, detection, and investigations of crime on the railways.”<sup>226</sup> The Government Railway Police is overseen by the Government Railway Administration, and works in partnership with the Indian Railways Security Force that is the local or district police force. The Indian Railways Security Force divides their responsibility into 16 different Railway Zones. Their mission statement and objectives are very impressive and are as follows.

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<sup>225</sup> BBC News, “Deadly China Blast at Xinjiang Railway Station,” April 30, 2014, accessed May 12, 2015, <http://www.bbc.com/news/world-asia-china-27225308>.

<sup>226</sup> Odisha Police, “Railway Police,” Government of Odisha, accessed May 20, 2015, <http://odishapolice.gov.in/?q=node/198>.

Protect and safeguard railway passengers, passenger area and railway property.

Ensure the safety, security and boost the confidence of the traveling public in the Indian Railways

Carry on an unrelenting fight against criminals in protecting railway passengers, passenger area and railway property.

Facilitate passenger-travel and security by removing all anti-social elements from trains, railway premises, and passenger area.

Remain vigilant to prevent trafficking in women and children and take appropriate action to rehabilitate destitute children found in Railway areas.

Co-operate with other departments of the Railways in improving the efficiency and image of the Indian Railways.

Act as a bridge between the Government Railway Police/local police and the Railway administration.

Adopt proactively all modern technology, best human rights practices, management techniques, and special measures for protection of female and elderly passengers and children, in the pursuit of these objectives.<sup>227</sup>

France: In 2006, following gang related violence against passengers on-board one of France's passenger trains, the Government of France created the National Railway Police Service. On New Year's Eve about 100 youth attacked, robbed, and sexually assaulted passengers as the train traveled from Nice to Marseilles. Passengers tried to barricade themselves in compartments as assailants trashed the train and threatened to kill victims who used cellphones to call for help. The youths that had earlier been vandalizing areas in Nice, were placed on the train by local authorities to be sent back to their communities. The police said the French National Railway Company, had assigned a four-man private security team to watch the suspects when the train left Nice, but the

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<sup>227</sup> Indian Railways, "Mission Statement and Objectives," Ministry of Railways, accessed May 8, 2015, [http://www.indianrailways.gov.in/railwayboard/view\\_section.jsp?lang=0&id=0,1,304,366,533,1007,1010](http://www.indianrailways.gov.in/railwayboard/view_section.jsp?lang=0&id=0,1,304,366,533,1007,1010).

guards got off a few stops later.<sup>228</sup> After this incident, the Minister of Interior created a police of railroads called the National Railway Police Service. The National Railway Police Service now falls under a national plan for the transport security that relates to all the transport networks (trains, bus, trams, and subways). The action of the police forces and the gendarmerie (National Guard) on these networks is coordinated by a unit of coordination of transport security placed at the General Directorate of the French National Police.<sup>229</sup>

Question 8: Does the freight rail system have a dedicated protection force, and who is responsible for the infrastructure? The United States freight railroad companies provide their own police force or rely on the local law enforcement agencies for protection. Railroad police are provided police authority from state and local governments and are authorized interstate authority by the federal government. All Class 1 railroads, UP, CSX, BNSF, Kansas City Southern, Norfolk, and the two Canadian Railways that are discussed in the Canadian section, have their own police force. The Regional and Short Line railroad companies can provide either their own protection or first contact the local law enforcement agency. A major source of support for the regional and short line railroads security is the American Short Line and Regional Railroad Association.

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<sup>228</sup> Sebastian Rotella, "Latest Youth Violence Unnerves France," *Seattle Times* January 5, 2006, accessed May 9, 2015, <http://www.seattletimes.com/nation-world/latest-youth-violence-unnerves-france/>.

<sup>229</sup> Railpol, European Network of Railway Police Forces, "National Railway Police Service (SNPF)," accessed May 1, 2015, <https://www.railpol.eu/site/france>.

The ASLRRA offers four major types of support in the area of security.

The Staff works closely on a daily basis with DHS, TSA, FRA, Association of American Railroad Security Operations Center, and other agencies.

Maintains emergency security contact information for all ASLRRA members

Publishes information on security for member use.

Serves as the contact point for all members in the event of an emergency and then can receive additional support and guidance by contacting the Railroad Alert Network Operations Center.<sup>230</sup>

All of the Class 1 police are provided support from the local, state, and federal upon request and in return will provide support to those authorities when needed. An example of this was when every officer from Norfolk Southern's Northern territory police unit, worked alongside the FBI, the United States DHS, New Jersey Transit Police Department, and state and local law enforcement to help provide security before, during, and after Super Bowl XLVII.<sup>231</sup> All of the Class 1 railroads use K-9 unit teams and all of the railroad companies are very aware of the target that their trains represent to terrorists. This can be seen by one of CSX's police specialized units, the Rapid Response Team that is responsible for rail counter-terrorism, whose goal is to ensure that rail infrastructure does not become a target of domestic or foreign terrorists. The Rapid Response Team is an interdisciplinary team that is composed of CSX Police special agents. Among them are explosive-detection K-9 teams, counter-surveillance specialists, and tactical response

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<sup>230</sup> American Short Line and Regional Railroad Association, "Safety and Training/Security," accessed May 5, 2015, [http://www.aslrra.org/safety\\_\\_\\_training/Security/](http://www.aslrra.org/safety___training/Security/).

<sup>231</sup> Norfolk Southern, "Staying Safe With NS Police," accessed May 8, 2015, <http://www.nscorp.com/content/nscorp/en/bizns/whistle-post/staying-safe-withnspolice.html>.

specialists, Hazmat managers with paramedic and engineer qualifications, and a medical support element.<sup>232</sup>

Other areas of focus for the freight railroad companies are hazardous materials, various types of crime and theft, and to help (as CSX describes) “provide essential and physical protection to sensitive rail shipments including military shipments, munitions, and spent nuclear fuel and protect the national strategic rail network vital to national defense and interstate commerce.”<sup>233</sup>

France: In 2006, following gang related violence against passengers on-board one of France’s passenger trains, France created the National Railway Police Service in 2006. Planning and coordination of security begins at a national level and collaborates with the railway operators, local police forces, and the National Gendarmerie.<sup>234</sup> The National Gendarmerie is a branch of the French Armed Forces in charge of public safety, with police duties among the civilian population. This would be equivalent to the United States National Guard. An example of infrastructure protection is shown by the British and French private security guards securing both sides of the Eurotunnel, protecting a complex railway system for international freight and passenger (Eurostar) trains. On both sides of the Channel, private security guards are assisting the French and British

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<sup>232</sup> CSX Police, “Specialized Units,” accessed May 10, 2015, [www.csx.com/index.cfm/community/csx-police-department/specialized-units/](http://www.csx.com/index.cfm/community/csx-police-department/specialized-units/).

<sup>233</sup> Ibid.

<sup>234</sup> Railpol, European Network of Railway Police Forces, “How We Work,” accessed May 10, 2015, <https://www.railpol.eu/site/C35F55C1AF1C79BAC1257A71006631B6>.



Authorities in detection of explosives. They operate X-ray machines, use K-9 units, and explosive detectors.<sup>235</sup>

China: As stated above in question seven, the National Police Agency of the Republic of China supplies all of the police forces at every level, local, regional, and nationally that includes all areas of transportation.

Canada has a large and well-developed railroad network, with 32,300 miles of track and one of the largest rail networks in the world. In Canada's railroad network, there are 31 federal railways. They include three national railways—Canadian Pacific Railway Limited and the Canadian National Railway Company, both of which are publicly traded companies, and Via Rail Canada Inc., a federal Crown corporation—and 28 smaller federal railways. Unlike other modes, rail provides and maintains its entire infrastructure and invests about 20 percent of revenue, an average of over \$2 billion every year, back into its network to improve transit time for shippers.<sup>236</sup> The two Canadian National Police Service and Canadian Pacific Police Service departments are the only federal railroad police services operating in Canada. Police officers for the railway are federally sworn under the Railway Safety Act. This Act allows a superior court (federal) judge to appoint a person as a police constable. These officers are employed by the railway and are in place strategically within Canada's rail infrastructure

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<sup>235</sup> Confederation of European Security Services, "Overview of Best Practices in Selected European Countries and Multinationals In Railway Security, France-Railway and Cargo Security," November 2013, accessed May 10, 2015, [http://www.coess.eu/\\_Uploads/dbsAttachedFiles/141114\\_CoESS\\_Contribution\\_to\\_LANDSEC\\_Best\\_Practices\\_Rail\\_Security.pdf](http://www.coess.eu/_Uploads/dbsAttachedFiles/141114_CoESS_Contribution_to_LANDSEC_Best_Practices_Rail_Security.pdf).

<sup>236</sup> Railway Association of Canada. "Freight-Class 1 Members," accessed May 5, 2015, [http://www.railcan.ca/rac/member\\_railways?type=Freight+-+Class+1](http://www.railcan.ca/rac/member_railways?type=Freight+-+Class+1).

with a primary focus of reducing deaths and injuries along each railway's network of operations. These officers typically work toward investigations involving criminal and provincial violations such as traffic enforcement and accident investigations and working to further educating the public about the dangers of rail operations and consequences that can result from complacency. To note Canadian National was a crown corporation until 1994 when it was transferred from government ownership to private industry. During this time, Canadian National Police officers were part of the federal government but after transitioned to working for private industry. These railroad police officers are also empowered to assist the provinces they are assigned. They can be used as support for the local authorities and in return, the local authorities can support the railroad police if necessary.

Russia utilizes the federal police agency and the military to protect and support all areas of the railroad. The federally owned Russia Railways ability to improve the quality of railway infrastructure is particularly important as railways dominate freight transport and serve large Russian industries, notably raw materials, which often have no transport alternative. After years of inattention to maintenance and repairs to Russia's extensive railway system, infrastructure degradation and increasing freight transport demand creates an even larger challenge. Russia is spending billions of dollars in an attempt to revitalize the railroad infrastructure but is still functioning with obsolete locomotives and railcars. An aggressive strategy that not only includes some privatization but also to replace the rolling stock with modern locomotives, passenger cars, freight cars, expand

High Speed Rail, and upgrade freight lines for heavier loads is part of the reform that is planned through 2030.<sup>237</sup>

India's Government Railway Police and the Railways Security Force have had a serious problem with terrorist attacks on the railways systems. Over two years, 2013-2014, there were 29 attacks resulting in 10 deaths and 33 injuries. These attacks included armed assailants, bombs on the train, bombs on the tracks, bombing infrastructure such as a bridge, and attacking workers on the railroad. All of these attacks disrupted movements and service.<sup>238</sup> In May of 2014, two low-intensity bombs were placed under seats and exploded killing one and injuring 14 as it pulled into the Chennai Central train station. Security at the railway station and baggage screening procedures were increased. Initially the National Investigation Agency and National Security Guard were requested, but then were put on hold. The local authorities oppose any central (federal) interference.<sup>239</sup> This would indicate strong friction between levels or agencies of government that could hinder security and the investigation. It was interesting to note the reports reviewed by the paper placed a type of classification on the bomb or size of the explosion. Even though there was a death and injuries on the report cited, the bombs were reported as low-intensity.

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<sup>237</sup> Chris Lo, "Russian Railways: Connecting a Growing Economy," *Railway Technology*, May 1, 2013, accessed May 8, 2015, <http://www.railway-technology.com/features/feature-russia-railways-connecting-growing-economy/>.

<sup>238</sup> SATP, "Terrorist Attacks on Railways in India," accessed May 12, 2015, <http://www.satp.org/satporgtp/countries/india/database/railwayattack.htm>.

<sup>239</sup> K. V. Lakshmana and Sudipto Mondal, "Woman Techie Killed, 14 Injured in Twin Blast on Train in Chennai," *Hindustan Times*, May 1, 2014, accessed May 12, 2015, [www.hindustantimes.com/india-news/blasts-at-chennai-central-station-casualties-feared/article1-1214248.aspx](http://www.hindustantimes.com/india-news/blasts-at-chennai-central-station-casualties-feared/article1-1214248.aspx).

Questions 9/10: Is the railroad system an economic benefit and would the country be affected by major disruptions or delay caused by terrorist attacks? The United States proudly boasts the most efficient and advanced freight system in the world. Many countries have used the United States freight system as a model to restructure an inefficient debt-ridden railroad industry into a freight railroad system that is a benefit to their economy. The United States freight rail industry delivers consumer goods, coal, chemicals, paper and lumber, motor vehicles, agricultural products, and massive amounts of minerals and fuel.<sup>240</sup>

The American Association of State Highway and Transportation Officials estimated that if all freight rail traffic were shifted to trucks, rail shippers would have to pay an additional \$69 billion per year. America's railroads account for 40 percent of intercity freight volume—more than any other mode of transportation—and provide the most efficient and affordable freight service in the world. The freight railroad industry provides more than 185,000 jobs and another additional one million jobs is attributed to the companies that provide services and goods or are recipients of spending by the employees of railroads and their suppliers.<sup>241</sup>

American's single national passenger rail service Amtrak, serves over 500 destinations and averages approximately 30 million passengers annually for an average of more than 86,000 passengers on over 300 trains per day. Amtrak reports that there are 2,200 commuter trains using Amtrak-owned infrastructure on the NEC with an average

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<sup>240</sup> Association of American Railroads, "The Foundation for America's Economy," accessed December 11, 2014, <https://www.aar.org/railroad-101>.

<sup>241</sup> Association of American Railroads, "The Economic Impact of American's Freight Railroads."

weekday ridership of 750,000. The NEC links the largest concentration of people, jobs, and economic productivity in the nation.<sup>242</sup> Although Amtrak requires federal funding to supplement inadequate revenues to balance expenses, Amtrak provides a necessary service that is considered a benefit to the United States transportation industry. A major disruption in the freight railroad system would have a serious impact on the nation's economy. A major disruption in Amtrak's ability to fulfill their services would cause a massive amount of inconvenience for the Long-distance routes and an undeniable disruption for the approximately 11 million riders annually in the NEC who would turn the highways into parking lots if required to drive to their destinations. The majority of the economic impact would be felt in the 2nd and 3rd order effects of those riders in the NEC and the business's that support the major cities in that geographical area. The NEC major cities are Washington, DC, Philadelphia, New York City, and Boston.

Canada has a large and well-developed railroad system that transports mainly freight and moves 70 percent of all intercity surface goods each year. Canadian National Railway is investing \$500 million over several years in infrastructure improvements to its Western Canada feeder rail lines used by the oil industry.<sup>243</sup> The passenger Via Rail is the only coast-to-coast passenger railway in Canada and transport approximately four million passengers a year. A major disruption or lengthy delay in Canada's freight rail could

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<sup>242</sup> Amtrak, "The Northeast Corridor," accessed May 14, 2015, <http://nec.amtrak.com/#>.

<sup>243</sup> CN, "CN Announces Multi-Year, C\$500-Million Capital Program to Upgrade Western Canada Feeder Rail Lines Carrying Rising Freight Volumes to and from North American and World Markets," April 16, 2015, accessed May 6, 2015, [www.cn.ca/en/news/2015/04/pressrelease\\_20150416103113\\_0115](http://www.cn.ca/en/news/2015/04/pressrelease_20150416103113_0115).

cause a major impact to the economy but not as significant if a major disruption was realized in the passenger rail industry.

China has made major changes in their rail system by dissolving the former Ministry of Railways in 2013, and establishing the China Railways Corporation. The railroad system will be asked to support even greater demands for the safe, efficient, fast, and economical movement of people, energy, and goods.<sup>244</sup> Both China and Russian's rail systems are challenged by the large geographical distances to move people and goods. China's freight railroad system, and then under the now dissolved Ministry of Railways, transported four billion tons of goods in 2012, which is twice the rate reported in 2000. However, as freight rail has increased, railroads overall dominance has been challenged by growth in the trucking industry, mainly over short distances. The need for quicker deliveries by truck is preferred by manufacturers and is a problem that challenges freight rail companies worldwide. For China's freight rail, this was caused by a majority of investments applied to highway construction over the last 30 years. Investments are now going back into rail with massive infrastructure improvements. Rail is the dominant transport for coal that is the primary energy source in China.<sup>245</sup> China is placing a heavy investment in the freight railroad to have a strong impact on their economy. China Railway Corporation is expected to raise freight rates early this year to relieve its massive debt burden and speed up market-oriented reform in the industry, which it

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<sup>244</sup> Robin Bordie, Stephen Wilson, and Jane Kuang, "The Importance, Development and Reform Challenges of China's Rail Sector," in *Deepening Reform for China's Long-Term Growth and Development*, ed. Ligang Song, Ross Garnaut, Cai Fang, (Canberra, Australia: Australian National University Press, July 2014), 477-506, accessed May 6, 2015, <http://press.anu.edu.au/wp-content/uploads/2014/07/ch19.pdf>.

<sup>245</sup> Bordie, Wilson, and Kuang.

monopolizes.<sup>246</sup> A major disruption or lengthy delay would have a large impact on their economy. China took an innovative step and began building separate passenger and freight lines in 2012. The decision to construct separate lines anticipates greatly increase traffic volume and addresses choke-point issues. No other rail system in the world is as vital as China's to the reliability of their national energy supply.

India's \$137 billion effort to increase the railroad infrastructure will help improve the annual freight carrying capacity by 50 percent.<sup>247</sup>

Indian Rail has a combined total of 10,000 locomotives for passenger and freight, 240,000 freight car, 63,000 passenger cars, and 7420 freight trains daily. India's passenger rail has a life of its own with an average between 21-23 million passengers a day and 10-12 passengers dying every day. Some fall off train roofs, are electrocuted, or are hit by the train as they run across the tracks. Surprisingly with 20-25 registered accidents a day, the trains always run on time. Most have seen a picture of the trains in India overloaded with passengers on the roof or hanging off the sides. The head of the police team in charge of accidents covering seven stations states that one in three victims are cremated or buried without identification being possible. The deceased are often rural migrants and their family has no idea they have disappeared.<sup>248</sup>

India has over 40,000 miles of track that ranks them as the fourth largest in the world, but most of the track was laid before 1947. This is the system, image, and reputation that India must overcome in its attempt to improve and invest heavily over the next five years,

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<sup>246</sup> Celine Sun, "Heavily Indebted China Railway Corp Expected to Raise Freight Rates," *South China Morning Post*, January 11, 2014, accessed May 12, 2015, <http://www.scmp.com/business/china-business/article/1402132/heavily-indebted-china-railway-corp-expected-raise-freight>.

<sup>247</sup> Panda.

<sup>248</sup> Julien Bouissou, "Mumbai's Rail Commuters Pay a High Human Price for Public Transport," *The Guardian*, October 29, 2013, accessed May 10, 2015, <http://www.theguardian.com/world/2013/oct/29/india-mumbai-population-rail-accidents>.

that will increase the number of passengers to 30 million a day,<sup>249</sup> (Amtrak's reported total passengers for the year in 2013 was 31 million) and will be increasing the overall track length by 8700 miles. India has a challenge of overcoming a reputation of having a poor quality of railroad infrastructure, but any major disruption would have a great impact with 23 million passengers a day. Although rail transportation is more cost-effective and environment-friendly than road, especially for long distances, and until recently, India's railway network has seen little new investment. It is seeking to restore the railways' competitive strengths by urgently adding dedicated freight-only lines along four key transportation routes. India's Dedicated Freight Corridor program is building dedicated freight-only railway lines along highly congested transport corridors. India recent commitment to improving the railroad includes the new electrified freight-only railway lines that will allow trains to haul higher loads faster, cheaper, and more reliably than before, enabling the railways to make a quantum leap in their operations.<sup>250</sup> In its current state a major disruption or delay of freight trains would have an impact on the nation's economy and would increase traffic on the already heavily congested road system.

Russia is the largest country in the world by territory and is characterized by great distances both between population centers and between suppliers of raw materials and their intermediate or end customers. The railway system is the key mode of transportation in Russia with an operational length of over 52,000 miles, making it the third largest rail

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<sup>249</sup> Panda.

<sup>250</sup> The World Bank, "India: Eastern Dedicated Freight Corridor Project," December 11, 2014, accessed May 15, 2015, <https://www.worldbank.org/en/news/feature/2014/12/10/eastern-dedicated-freight-corridor-project>.



network in the world in terms of track length.<sup>251</sup> Ninety percent of freight transport in Russia comes from the railway industry.<sup>252</sup> Russian railways remain essential in long-haul passenger transport serving more than 40 percent of all passengers. Improving transport connectivity among major cities through the construction of the high-speed railway (HSR) has also long been an important item on the policy-making agenda. The first HSR program was approved in 2006 envisioned 21 HSR routes being completed by 2020. Russia has seen significant investment and development in the passenger rail system over the last decade and the rail system remains an essential part of Russia's security and economic position. Passenger rail is also essential to economic growth—not just for travel and tourism, but also for the mobility of the labor force.<sup>253</sup>

Many of Russia's natural resources are in remote, harsh, and sparsely populated regions of Siberia and the Russian Far East that have underdeveloped road infrastructure and are far removed from the main population centers in European Russia. Railways connect 79 of Russia's 85 regions and provide services to most major cities, having a direct impact on growth, industrial development, and regional integration. Much of the population relies on the railways because of the limited road networks, huge distances,

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<sup>251</sup> Globaltrans, "Industry Overview."

<sup>252</sup> Alexander Kolik, Ph.D., Artur Radziwill, and Natalia Turdyeva, ECO/WKP 1193(2015)11, "Improving Transport Infrastructure in Russia" (Economics Department Working Papers, Organisation for Economic Co-operation and Development, Paris, France, March 25, 2015), accessed May 10, 2015, <http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ECO/WKP%282015%2911&docLanguage=En>.

<sup>253</sup> Kolik, Radziwill, and Turdyeva.

and the remoteness from large parts of the country.<sup>254</sup> Russia, because of the limited road networks, huge distances and the remoteness from large parts of the country, relies heavily on the railroad systems and a major disruption or delay in the system and its services would be of great impact to the Russian economy.

France with 20,000 miles of railroad continues to innovate with the first High Speed freight train and the longest freight train in Europe. However, France also has the largest natural and man-made waterways network in Europe and much of the freight is transported in a manner that restricts the potential of growth of France's freight rail system. In addition, a majority of the oil is transported by the pipeline system and a disruption in freight rail would not have much of an impact on the economy. A major disruption in the passenger rail system would have a larger effect on the economy than a disruption in the freight system would.

Table 8 below was created to compare the United States railroad system with five other countries railroad systems. The following 10 criteria questions were researched as they apply to the United States. The same 10 criteria questions were then applied to the five other country's railroad systems to draw a comparison between the six countries.

1. Form of government.
2. How many miles of railroad are there in the country?
3. Data depicting the total number of locomotives of passenger and freight, freight cars, and passenger cars.
4. Data depicts the annual passengers per year.
5. Is the private railroad system government or privately owned?

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<sup>254</sup> PIO Russian Railways, "Overview."

6. Is the freight railroad system government or privately owned?
7. Does the passenger railroad system have a dedicated protection force?
8. Does the freight railroad system have a dedicated protection force?
9. Are the railroad systems an economic benefit to the country?
10. Would a major disruption in service of the freight or passenger railroad systems have a negative impact on the country's economy?

Table 9. Complete Criteria Comparison Chart

Areas of Study	United States	Russia	China	France	Canada	India
Form of Government	Democracy	Communist	Communist	Republic	Parliamentary Democracy	Federal Republic
Rail Miles	140,000	52,000	41,000	20,000	31,000	40,000
Locomotives	25,000 F 400 P	20,000 C	20,800 C	3,500 P	80 P F-UA	10,000 C
Freight Cars	1,335,640 *	750,000	688,000	UA	146,300 *	240,000
Passenger Cars	1600	24,200	59,000	UA	400	63,000
Annual Passengers	30 Million	1.3 Billion	2.1 Billion	1 Billion	4.1 million	8 Billion
Passenger Rail Private or Government Owned	Government Owned	Government Owned	Government Owned	Government Owned	Government Owned	Government Owned
Freight Rail Private or Government Owned	Private	Both	Government Owned	Both	Private	Government Owned
Passenger Railroad Protection Force	Amtrak Police Force	Government Police Force	Government Police Force	National Railway Police Service	Via Rail Police Service	Railroad Protection Force
Freight Protection Force	Yes- Private	Yes Government Police Force	Yes Government Police Force	National Railway Police Service	Yes	Yes Government Police Force
Railroad System Economic Benefit	Yes	Yes	Yes	Yes	Yes	Yes
Would Disruption Affect Economy	Yes Freight more than Passenger	Yes Both	Yes Both	Yes Passenger More than Freight	Yes Freight more than Passenger	Yes Passenger more than Freight
	United States	Russia	China	France	Canada	India

Source: Created by author. P=Passenger F=Freight C=Freight + Passenger \* =All Owners UA=Unavailable

Tables 2 to 4 are populated below with data now represented as tables 10 to 12.

Table 10 reflects the number of terrorist attacks on each country's railroad system from

2008-2014. Table 11 reflects the GTI rankings for the six selected countries for 2012 and 2014. Table 12 reflects the GTI rankings for the top five countries with the highest incidents and most affected by terrorist attacks.

Table 10. Terrorist Attacks on Railroad Systems, 2008-2014

Country 2008-2014	# Of Attacks	Injuries	Deaths
United States	0	0	0
India	131	423	162
Russia *	7	249	87
China *	N/A	N/A	N/A
Canada *	0	0	0
France	1	0	0

*Source:* Created by author using SATP, “Terrorist Attacks on Railways in India,” accessed May 12, 2015, <http://www.satp.org/satporgtp/countries/india/database/railwayattack.htm>; Roland Oliphant, “Nevsky Express Train Attack: Russia Tray to Uncover Terrorists Behind the Bombing,” *The Telegraph*, December 9, 2009, accessed May 20, 2015, <http://www.telegraph.co.uk/sponsored/rbth/society/6771546/Nevsky-Express-train-attack-Russia-trying-to-uncover-the-terrorists-behind-the-bombing.html>; William Robert Johnston, “Terrorist Attacks in Russia (with Statistical Summary),” last updated May 22, 2015, accessed May 5, 2015, [www.johnstonsarchive.net/terrorism/terror-russia.html](http://www.johnstonsarchive.net/terrorism/terror-russia.html); UPI, “Device in French Nuclear Train Crash Tied to Fatal Derailment,” July 19, 2013, accessed May 6, 2015, [http://www.upi.com/Top\\_News/World-News/2013/07/19/Device-in-French-nuclear-train-crash-tied-to-fatal-derailment-same-day/53941374254543](http://www.upi.com/Top_News/World-News/2013/07/19/Device-in-French-nuclear-train-crash-tied-to-fatal-derailment-same-day/53941374254543); Michael Kan, “China Blames Terrorism on Technologies to Bypass Internet Censorship,” *PC World*, March 6, 2014, accessed March 3, 2015, <http://www.pcworld.com/article/2105740/china-blames-terrorism-on-technologies-to-bypass-internet-censorship.html>.

Note: Russia’s terrorist attacks of all types for 2008-2014; number of attacks-60/injuries-557/deaths-154; Canada: a plot to derail a Via Rail passenger train was successfully stopped by the FBI; China: this research paper found two credible reports of attacks on

the railroad system. However, numerous media reports of the inability to document accurate information on terrorist attacks due to the censorship practices of the Chinese Government causes the overall data for China in table 9 to be unreliable

Table 11 reflects the rankings of the six countries in this paper's study based on GTI's ranking of 162 countries. The ranking of one represents the worst ranking.<sup>255</sup>

#### GTI Scoring System

The GTI score for a country in a given year is based on a unique scoring system to account for the relative impact of incidents in the year. There are four factors counted in each country's yearly score:

Total number of terrorist incidents in a given year.

Total number of fatalities caused by terrorism in a given year.

Total number of injuries caused by terrorism in a given year.

The approximate level of total property damage from terrorist incidents in a given year.

Each of the factors is weighted differently and a five year weighted average is applied to reflect the lingering psychological effect of terrorist acts over time.<sup>256</sup>

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<sup>255</sup> Institute for Economics and Peace, "Global Terrorism Index 2014: Measuring and Understanding the Impact of Terrorism."

<sup>256</sup> Ibid.

Table 11. GTI Ranking

Country	Ranking 2012	Ranking 2014
United States	41	30
India	4	6
Russia	9	11
China	23	25
France	63	55
Canada	74	84

*Source:* Created by author.

Table 12 reflects the countries with the highest incidents and most affected by terrorist attacks.<sup>257</sup>

Table 12. Countries with Highest Incidents Most Affected by Terrorist Attacks

Top 5	Ranking 2014
Iraq	1
Afghanistan	2
Pakistan	3
Nigeria	4
Syria	5

*Source:* Created by author.

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<sup>257</sup> Institute for Economics and Peace, “Global Terrorism Index 2014: Measuring and Understanding the Impact of Terrorism.”

All of the above tables and data point to the United States, France, and Canada as having less violence and terrorists attacks against the nation's railroads systems. These tables do not indicate other targets of attack but this author's unofficial opinion from readings would suggest that all of the countries would show an increase in attacks, but Russia, China, India, and France's increase would be more substantial. There does not appear to be any one area that would be an indicator of potential attacks on the railroad system. A combination of two or three of the areas does seem to show an indication of potential attacks and those three would be: Form of government, Number of passengers, and GTI rank. Russia, India, and China are the top three in GTI and number of passengers. China and Russia have communist governments, which would seem to cause strife, but India does not have a communist government. Communism is usually associated with oppression, lack of human rights, media control, and control over the population by the threat of violence. Through additional research, India ranks high on the amount of recognized terrorist groups in a country. The high number of terrorist groups and the history of conflict and friction with Pakistan could explain the exceptionally high number of attacks. China's media control and censorship does have the desired affect for restricting the details of an event but does not change the world perception or knowledge that media control it is a pillar of their government and thus neutralizes their desired effect.

One other note is that the United States has done well in preventing the type and number of terrorist's attacks experienced by the other countries. The United States is unfortunate to have experienced the tragic deaths of 2,977 innocent people during the attack on September 11, 2001, and that places us in a category by ourselves. The



environment is changing, the threat is rising, and the question becomes, is our resistance to terrorist attack because of our planning, preparation, and execution, or is it a combination of those efforts and that the United States has not been challenged in that arena?

### The Need for New Technology

This paper has discussed much of the doctrine and about the government agencies that provide the oversight and funding for the protection of the United States railroad industry. There is still a large gap in funding allocated for security between the aviation and railroad industries. It appeared in 2009 that the gap was shrinking when the railroad industry was given an extra \$11 billion in the budget. President Obama wanted HSR to be his signature transportation project; however, the project never really got off the ground, and the United States still is far behind Europe and China. In July of 2014, the administration asked Congress for another \$10 billion for high-speed initiatives.<sup>258</sup> This paper also discussed in length the different layers of protection provided by the APD and the joint efforts with other law enforcement entities for exercises and programs such as the VIPR team. Those levels of protection that are in place are excellent and the Amtrak personnel that place themselves on the front line to protect the passengers and employees are to be commended. The question is, are these layers enough?

1. National Communications Center
2. Police Officers
3. K-9 Units

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<sup>258</sup> Nixon.

4. Special Operations Unit
5. Intelligence and Counter-Terrorism teams
6. VIPR Teams
7. RAIL SAFE exercise and public awareness campaigns
8. Random searches, screenings, and ID checks
9. Behavior Assessment Screening System<sup>259</sup>

With the growing threat recently stated by the FBI director, the development and need of protection of HSR, and the current levels of protection for this country's passenger railroad, there is a need to bridge the security gaps. New technologies for protection of the passenger and freight railroad systems will be vital in the growing threat of terrorism. In the aviation industry, the current state of protection from terrorist attacks depends heavily on technology. Screening passengers, baggage, ID verification equipment, No Fly list, equipment that checks for metallic and non-metallic weapons, and most important is the overall goal and attitude of zero tolerance for failure. All of those are available for the passenger rail industry but it appears the industry has determined that those lines of defense are unacceptable. This is considered unacceptable because of the openness of the system, inconvenience, and rapid pace of the industry. In most every study this paper reviewed, passenger long rail and transit/commuter were in different categories, as they should be. However, when it comes to the discussion of adding levels of security, such as the screening of passengers and baggage, they are

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<sup>259</sup> Amtrak Police Department, "Amtrak Police Department," accessed February 7, 2015, <https://police.amtrak.com/>.

suddenly combined as one and the entire argument then becomes focused on the fact that screening would cause massive delays.

The layers of protection provided by Amtrak listed above are layers that are designed for the transit-commuter environment. There is a need for an expanded line of thought that develops a different set of criteria and methods of protection for the Long Distance routes. This is not only needed to effectively protect the Long Distance routes but as seen by the heavy funding, HSR is coming and these trains will create higher risk and an even more attractive target to terrorists. Although the following statement only compares HSR to the commuter or light rail the message is the same that Long Distance routes and HSR should be treated differently than commuter trains.

When it comes to security for high-speed rail, the approach needs to be different from that for light rail or commuter rail. The reason is simple; the approach that terrorists take is different, when terrorists attack high-speed rail systems, they seem to prefer to derail trains. When they go after non-high-speed rail systems, they more often try to detonate bombs in passenger compartments. Bombs placed on the tracks on average are twice as lethal for high-speed rail as those placed in the passenger cars. For non-high-speed rail, bombs in passenger compartments have proved to be more lethal than bombs on the tracks. Derailments that involve a mechanical means of sabotage (ex. removing bolts from rails) can be more lethal than bombs on the track.<sup>260</sup>

Technology has been the key factor in history that has played the supporting role to bridge and fill the gaps of human error and limitations. Technology is now advancing so rapidly that the horizon where current technology becomes obsolete becomes shorter and shorter. Almost every innovation creates the knowledge and technology that fosters the ingenuity required to generate the next technological breakthrough. This author can

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<sup>260</sup> Kim Kaiser, "High-Speed Rail Security Needs a Different Approach than Commuter Rail," *Mass Transit*, August 11, 2011, accessed May 9, 2015, <http://www.masstransitmag.com/article/10317151/high-speed-rail-security-needs-a-different-approach-than-commuter-rail>.

speak from 29 years of experience as an Air Traffic Controller to the development and benefits of new technology in the Enroute Air Traffic Control environment. The idea of technology replacing the air traffic controller with their rare abilities and skills, that ensure aircraft arrive in a safe and expeditious manner to their destination has always been present. Although technology is bringing the system closer to that objective and the closer rate on that goal is increasing, but this author believes another generation of controllers will successfully use their skills and complete their careers before the title changes to Air Traffic Monitor.

It is interesting that the Department of Defense's (DOD) United States Army War College strategy conference held in April 2014, suggested that with the proliferation of technology and information, the asymmetric adversary "could now pose a threat with the many cheap and small precision systems that are now available."<sup>261</sup> The report went on to suggest that the Joint Forces will have to think about how to take advantage of the small and cheap, as well as new technologies and approaches that serve to restore the offense to the battlefield. It is important that the passenger rail industry use more of the existing technology that is available while identifying the capability gaps and endeavoring too aggressively develop new technology to meet those gaps. This existing technology can be applied in a manner that is strategic and does not overwhelm the system. With the thought of long rail passenger (Amtrak) not joined to transit rail, some additional levels

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<sup>261</sup> Joint Chiefs of Staff, *Joint Staff J-7 Future Joint Force Development Observations and Insights Report, May 2, 2014*, U.S. Army War College 25th Annual Strategy Conference, "Balancing the Joint Force to Meet Future Security Challenges," 8-10 April 2014, accessed May 8, 2015, [http://www.strategicstudiesinstitute.army.mil/conf/docs/2014\\_J-7\\_ConfReport.pdf](http://www.strategicstudiesinstitute.army.mil/conf/docs/2014_J-7_ConfReport.pdf).

of protection can be applied. The next section below will address the technologies that could impact passenger and freight rail.

### Challenges and Options for Passenger Rail

The following is a list of challenges created by this author, in an earlier discussion but with some adjustments about the possible gaps in Amtrak Security. This list displays existing methods of security that Amtrak chooses not to implement. This author is aware that Amtrak does understand their security vulnerabilities but has apparently weighed the benefit against the possible cost and has determined that no action is needed. All of the items listed below could be applied to Long Distance Routes without affecting the commuter routes.

1. Amtrak passengers are allowed to purchase tickets after boarding.
2. Amtrak does not authenticate ID documents.
3. Amtrak does not have a No Ride list.

Passenger manifest submitted to DHS is not mandatory but Amtrak voluntarily submits this information for the trains that cross the Canada/United States border. The manifest checks for passengers that pose a risk or threat to national security. This is a Policy issue that can only be corrected by the United States Government.

4. Amtrak only has a limited armed presence on the trains and the 500 station locations.

5. Amtrak has no checked baggage screening Amtrak has no WTMD-checks for metallic weapons Amtrak has no AIT-checks for metallic and nonmetallic weapons.

The following are options to address the challenges above.

1. Discontinue the ability to purchase a ticket after boarding the train: This method of purchasing a ticket only requires showing ID after the train is probably moving is a dangerous practice. Amtrak provides a variety of tickets, from the multi-ride to the Tour of America ticket. This would be a reduction in revenue and this author was unable to find the revenue generated from on board ticket purchases but would estimate these sales would be a minimal fraction of overall sales. The benefits of safety and protection far outweighs the potential of this one small stream of revenue. This would apply to all Amtrak trains;

2. All passengers must present an ID before boarding and have ID document verification: Verification of a valid government issued document not only is proof of ID, but also is a deterrent of the use of fraudulent and stolen forms of identification. The use of ultraviolet tools would be used when purchasing a ticket from an agent or when presenting a ticket prior to boarding. This would apply to all trains where ID must be presented to board excluding commuter train routes.

This proposal would remove the practice of purchasing a ticket from a kiosk and boarding without showing proper ID. This verifies that all passengers have presented their ID for a security check before boarding an Amtrak train. This would require a method of verifying the ticket purchaser's identification and comparing it to the No-Ride list. One option that could be investigated would be a version similar to TSA's four Trusted Traveler programs. For this discussion, the PreCheck Application Program that is one of the four will serve as a basic outline and example. The TSA PreCheck program "allows low-risk travelers to experience expedited, more efficient security screening at

participating U.S. airport checkpoints for domestic and international travel. Interested applicants must visit an application center to provide biographic information that includes name, date of birth and address.”<sup>262</sup> With the challenge of verifying identification at kiosk and unmanned stations, riders who choose to purchase their tickets in this manner would first have to provide proof of identification. This possible program could require a registration of once every five years as are the four Trusted Traveler programs and could be accomplished either online, at one of the already established TSA application centers, or through a similar arrangement with Amtrak at minimal or no cost to the applicant. This program would then provide the same security benefits as the No-Fly list and actually increase the overall situational awareness that would come from information sharing between transportation modes and the fusion centers. Having the technology to overcome similar issues and the fact that Secure Flight and the No-Fly list already provide the necessary information and template to implement a No-Ride list, leaves little reason not to take advantage of this opportunity. This would apply to all trains where ID must be presented to board excluding commuter train routes.

3. A No-Ride list verification for all routes except for commuter routes: The idea of a No-Ride List was discussed in 2011, and was proposed in Congress but never passed into law. A pillar of the effort in the whole of government approach is information sharing. Amtrak is part of the Joint Task Terrorist Force and the Intelligence Fusion Centers and a No-Ride list should be developed especially with the statement made by FBI Director James Comey on May 7, 2015, “that there are as many as thousands(sic) of

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<sup>262</sup> Transportation Security Administration, “TSA PreCheck Application Program.”

people inside the United States taking in ISIS' online poison. We have a very hard task in trying to identify and stop anyone inspired to launch an attack inside the U.S. homeland, Comey said.”<sup>263</sup> This statement was supported by “federal agents that suggested there are hundreds of ISIS followers in the United States who are now being bombarded on the internet with calls to take deadly action.”<sup>264</sup> One of the main arguments against the previous attempt to establish a No-Ride list was the terrorists were not inside our borders and therefore a No-Ride list was not needed to monitor the trains or buses traveling within the United States. With the statement made by FBI Director Comey it appears that argument is no longer valid and there is mounting evidence that those who pose a risk or threat to national security could easily be using the trains. Terrorists seek out gaps in security, vulnerabilities in the system, and targets that will provide the greatest amount death, destruction, and media coverage. In this author's opinion, passenger trains meet all of those criteria and it is now too great a risk to not the raise the bar on security. Amtrak voluntarily provides information on passengers crossing the United States-Canada border to the intelligence community, but this should now be mandatory.

4. Add Amtrak Officers, Rail Marshals or Armed Crew Members: The APD website describes the 500 officers that are located at over 30 locations. With over 500 destinations, this results in a majority of the stops being unprotected and at the mercy of

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<sup>263</sup> Randy DeSoto, “FBI Director Warns: Potentially ‘Thousands’ of ISIS Followers in US,” *Western Journalism*, May 8, 2015, accessed May 8, 2015, <http://www.westernjournalism.com/fbi-director-warns-potentially-thousands-of-isis-followers-in-us/>.

<sup>264</sup> Dale Hurd, “FBI Director: ISIS Online Influence Growing in US,” *DBN News*, May 8, 2015, accessed May 8, 2015, <http://www.cbn.com/cbnnews/us/2015/May/FBI-Director-ISIS-Influence-Growing-in-US/>.



local law enforcement budgets for support. Only having a constant and enduring presence in the busiest stations and the busiest trains is no doubt utilizing a risk-based approach. It was discussed earlier in this paper what must be determined through this risk-based methodology and made available to the public is that the protective measures implemented through this analysis method is the acceptance of prudent risk and not gambling on the safety of passengers. This is an opportunity to further reduce the accepted level of prudent risk and provide an even greater visual presence and deterrence, which is now the foundation for the current method of protection. This author would propose at least doubling the Amtrak Officers that are on the front lines, in the stations, and on the trains.

If that is not considered a viable option then a second suggestion would be adding Rail Marshals as a new level of protection, both visible and undercover, with an information campaign describing the extra layer of protection. This would bridge the security gap of vulnerability when the trains are in transit and when the trains arrive at the stops. The local law enforcement is an integral part in the response and visual deterrent portion of the strategy but they also have primary roles to fill in their jurisdictions. The Amtrak station in this author's town has about 100 riders a day and having been there more than a few times to drop off or pick up a family member, this author has never seen any type of law enforcement presence. This proposal is not new but would be a force multiplier as a deterrent, provide public knowledge that there are armed personnel on the train and at each stop as the train arrives, and would provide a means of rapid response if necessary.

A third option would be to arm the conductors that already move throughout the train, are trained in the BASS or SPOT, and could be trained in the use of a firearm. This proposal would add to the visual deterrent that is the foundation of the security strategy of Amtrak. This proposal would benefit the commuter trains and the NEC that has the highest percentage of riders, but this thesis will only look at the non-commuter trains.

Amtrak does use Air Marshals as part of the VIPR team. The Amtrak police officers and the K-9 bomb teams patrol the stations and platforms, and do ride on some of the busier trains to provide a visual deterrent. These efforts are only random but are an exercise of effort and a valuable visible deterrent. However, with acknowledgement by the FBI Director of “thousands of people now in the United States taking the ISIS online poison,”<sup>265</sup> random may no longer be enough for a system that by most every report is open and vulnerable.

5. Limited Passenger and Baggage Screening: Utilizing AIT systems, also known as full-body scanners, would identify metallic and non-metallic weapons on the Long Distance Service routes, and would be preferred over the walk-through metal detectors. To address any privacy issues with the AIT systems, the TSA was mandated to ensure that current and future AIT systems are equipped with ATR software, which displays generic outlines of passengers rather than actual images.<sup>266</sup> Also, screen carry-on and checked baggage only on the long Distance Service routes. Typically, these riders have arrived at the station early and have planned for additional travel time. This would

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<sup>265</sup> DeSoto.

<sup>266</sup> Mark Rockwell, “The Business of Federal Technology, TSA Completes Addition of Privacy Software to Airport Scanners,” FCW, June 3, 2013, accessed March 30, 2015, <http://fcw.com/articles/2013/06/03/tsa-scanner-software.aspx>.

require a public information campaign that most travelers on these routes would adjust to quickly. This would be an informative test case and if successful could be expanded to all routes except for commuter routes. This proposal maintains the separation of long passenger and commuter rails. On the following page, there will be more discussion on the new passenger screening technology.

As stated before, the combination of new technology and newer versions of existing technologies may be necessary to develop the capabilities that cover the gaps. Even though new technologies for the protection of passengers can come at a high financial cost, this hybrid of technology can fit into the risk management process of prioritization. However, sometimes this process can simply take too long to complete and that requires a line to be drawn.

When Congress mandated in 2008 that the freight railroad companies would develop the new PTC system and be completed and functioning by the end of 2015, they were well aware that some of the technology required for this system had not yet been developed. In order to meet those requirements the freight companies had to determine what capabilities they currently had and then determine how to develop a finished product that would meet those needs. By evaluating in this manner, they determined what the capability gaps were and began to develop the new technology to bridge those gaps. This is exactly what the DOD does to meet the guidance given from the executive and legislative branches and strategic documents developed from the *Quadrennial Defense Review*, *National Defense Strategy*, *National Security Strategy*, and the *National Military Strategy*. These inputs are used to develop the necessary warfighting capability that will be provided to the Combatant Commanders in order to defend our nation and national

interests. The military uses a problem-solving construct that assesses current capabilities and manages change called DOTMLPF that is an acronym for (Doctrine, Organization, Training, Materiel, Leadership-Education, Personnel, and Facilities). When a capability gap is identified, a search for a solution is tested against each of the DOTMLPF elements. If no solution is found then a new product is developed to meet the gap as long as it is affordable, feasible, and meets the needs of the combatant commander. The railroad system has security and protection capability gaps that need to be addressed within the next 10 years that necessitates a deadline be set, as was done with PTC, to meet those security gaps.

Passenger screening equipment that can process many passengers concurrently and rapidly should be a capability given priority and a completion date set, just as was done with PTC. The technology to accomplish this is getting closer with Standoff detection technology that is advancing and showing promise. Standoff technology can detect explosive residues from a distance and could provide non-invasive imaging systems, which would detect anomalies that could be explosives or conventional weapons such as guns. Both imaging and trace detection technologies could be used to screen people before they enter buildings or public areas.<sup>267</sup> The biggest challenges in standoff detection are extending the distance range at which effective identification can occur, improving signal detection over atmospheric and environmental noise and interference,

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<sup>267</sup> Department of Homeland Security, “Standoff Detection Program,” accessed May 9, 2015, <http://www.dhs.gov/science-and-technology/standoff-detection>.

and screening of multiple in-motion threats.<sup>268</sup> Some of the newer standoff technology is reported to have a range of up to 300 feet but can only recognize a single individual at a time.

Some of the new advanced passenger screening products now being used in many airports quickly screen passengers for a broad variety of possible means of attack, including both metallic and non-metallic: weapons, standard and homemade explosives (sheet and bulk), liquids, gels, plastics, powders, metals, ceramics, and other objects. The scan is completed in 1.5 seconds, provides the data needed to assess an individual, meets all of the health and privacy concerns, and can process 200-300 people per hour.<sup>269</sup>

The TSA is testing a new piece of high-tech baggage screening equipment at selected airports to screen checked baggage instead of having TSA officers manually inspect each piece of baggage whether it is a suitcase, duffel bag, knapsack, box, golf bag, or other item. “With the addition of this new state-of-the-art security technology, only bags that alarm will need a manual inspection by our TSA officers.” The current method of screening checked baggage for explosives is conducted manually by using explosive trace detection equipment. TSA officers have been opening each checked bag and swabbing it for traces of explosives before allowing the bag to be loaded onto aircraft. This new system being tested will screen baggage automatically and will alert

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<sup>268</sup> Valerie Coffey, “Advances in Standoff Detection Make the World Safer,” *Photonics Spectra*, accessed May 9, 2015, <http://www.photonics.com/Article.aspx?AID=53439>.

<sup>269</sup> L3 Security and Detection Systems, “L3 Compact Advanced Passenger Screening,” accessed May 9, 2015, [www.sds.l-3com.com/advancedimaging/provision-2.htm](http://www.sds.l-3com.com/advancedimaging/provision-2.htm).

TSA officials if something inside needs a closer inspection by a TSA officer. It is faster and more efficient.<sup>270</sup>

Technology such as these would be effective, efficient, and provide a necessary element to establish a new level of security for passenger rail. Although the standoff detection equipment would not be necessary to begin the new additions to security for passenger trains, this author feels that it will become a vital part of the protection strategy. Current technologies exist that would fulfill all of the concerns listed above and that are needed for passenger and baggage screening for long distance passenger routes. The last element left needed to start the process of acquiring the needed equipment and personnel, is for the proper authority to make a decision to do it.

### Technology for Freight

The freight railroad companies have prospered since the railroad industry was deregulated through the Staggers Act in 1980:

Congress passed this act that instituted a system of balanced regulation in the rail industry, ushering in a new era in which railroads could largely decide for themselves—rather than have Washington decide for them—what routes to use, what services to offer, and what rates to charge. Since Staggers, average rail rates have fallen 42 percent, train accident rates are down 79 percent, rail traffic volume has nearly doubled, and railroads have reinvested \$575 billion (updated)—their own funds, not government funds—back into their systems.<sup>271</sup>

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<sup>270</sup> Transportation Security Administration, “TSA Introduces New Baggage Screening Equipment at Ithaca Tompkins Regional Airport,” U.S. Department of Homeland Security, May 21, 2014, accessed May 10, 2015, <http://www.tsa.gov/press/releases/2014/05/21/tsa-introduces-new-baggage-screening-equipment-ithaca-tompkins-regional>.

<sup>271</sup> American Association of Railroads, “The Impact of the Staggers Rail Act of 1980,” May 2014, accessed May 9, 2014, <https://www.aar.org/BackgroundPapers/Impact%20of%20the%20Staggers%20Act.pdf>.

The freight companies take care of most all of the railroad infrastructure (Amtrak owns 730 miles) included in a majority of the 140,000 miles of track. Some of the funds come from grants through the government but a preponderance of the funding is supplied by the companies themselves. They inspect over 100,000 bridges and tunnels, provide intrusion detectors on those bridges, tunnels, and right-of-ways, provide their own police force, and protect their own yards, trains, and tracks. They have been mandated at times to develop new technology and capacities at their own cost, (there are some special grants for mandates for infrastructure improvements) such as PTC and new tank cars, both beneficial to the American public.

The United States freight railroad companies have built an industry that is matched by no other country, is a strong component of the economy, and provides a large competitive advantage for United States businesses. When the industry wants or needs new technology they are only restricted by what they want to accomplish and not the government processes and budget. This industry is flourishing, and maintains its position by staying on the cutting edge of technology.

As stated before, the rail inspection technology has become more vital as accidents involving trains carrying loaded tank cars have brought into question the reasons for the derailments.

An example of staying on the cutting edge is BNSF and the use of UAV or UAS, which encompasses additional ground-based support. In March, BNSF was granted permission by the FAA to begin monitoring its tracks with small UAS.

UP's Chief Executive Officer stated, "They would be perfect for safety checks on their 400 miles of bridges. You could send a drone (UAV) to do the inspection and then if it saw something you could send a person up to do the final inspection."<sup>272</sup>

Another example for the use of UAVs would be in response to a derailment. A UAV could be equipped with sensors for toxic chemicals commonly carried in tank cars or specific chemicals that may have spilled in a derailment. The UAV could immediately send information to the operator that could determine whether there was a leak of deadly toxins, positions of the derailed cars, and a camera could show any fires. UAVs could hover steadily over the train and/or be strategically maneuvered to send back images with close-up views. This could save manpower and provide a layer of safety that could save the lives of responders.

One capability gap that was discussed earlier was the issue of the annual average of 3,300 trains colliding with vehicles at crossings. This paper made an earlier suggestion of setting up direct communication between the engineer and a trained official observing a closed circuit television feed of the crossings who could provide warning if necessary.

Another suggestion would be an onboard radar system that would only require a range distance of approximately five miles in front of the train. It would also be beneficial to be able to see a few miles behind the train in case the train needed to back up and even a shorter distance on the sides for right-of-way security. This would make great strides in the reduction of crossing collisions and the ability to detect a potential

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<sup>272</sup> Thomas Black, "Drones Patrol Abe Lincoln's Railroad in Vision for Future," Bloomberg, May 4, 2014, accessed May 9, 2015, <http://www.bloomberg.com/news/articles/2014-05-05/drones-patrol-abe-lincoln-s-railroad-in-vision-for-future>.



attack from a VBIED that would normally come from the front or the right-of-way along either side.

The technology for on-board Radar for freight and passenger trains is conceivable with today's innovative advances in metamaterials<sup>273</sup> that are already being developed for on-board radar systems for drones and UAV, and a new generation of autonomous vehicles. The developers believe their application of this new technology “provides a superior sensor that can accurately detect objects and their relative distance, while current optical systems may require multiple sensors. Unlike other machine vision technologies, this system works in rain, snow, darkness, dust, and other low-visibility conditions, while optical systems all start to fall apart when you introduce any kind of environmental variables.”<sup>274</sup> If this system can be placed on a UAV or in a car then it would certainly be effective in a train.

This paper has addressed the primary research question: How can the United States ensure that vulnerabilities to our railroad system are identified and appropriate measures developed and implemented? This paper has also addressed the question: Is the present level of security sufficient to protect the United States railroad systems from terrorists attack? However, there is another element the United States was built on that is not included in the physical technology or a process such as risk-based analysis. This is

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<sup>273</sup> Metamaterials are artificially structured materials used to control and manipulate light, sound, and many other physical phenomena.

<sup>274</sup> Benjamin Romano, “Echodyne Targets Drones, Self-Driving Cars with Metamaterials Radar,” Xconomy, March 17, 2015, accessed May 9, 2015, <http://www.xconomy.com/seattle/2015/03/17/echodyne-targets-drones-self-driving-cars-with-metamaterials-radar/2/>.

the resolve, the steadfastness, and determination of this country that has stood in the face of threats and the desire of our enemy to destroy us.

Up to this point in history, our methods and layers of protection have been sufficient to deter attacks on our passenger and freight rail systems. This has been possible in part because the United States has been fortunate to have two large bodies of water protecting much of our border and leaving only two borders to protect. To the north, Canada has always been an ally and even though their support and participation in wars is not guaranteed, we never have to worry about them invading. Mexico to the south is an ally, but one we certainly have had difficult points in history with, one that we will also have to verify and help them keep our mutual agreements. Their actions and ability to monitor their side of the border with crime and illegal immigration issues is deliberately weak, but they never hesitate to ask for financial assistance for a variety of reasons. However, for the foreseeable future the United States should not have to worry about a Mexican military invasion. Comparing this geographical position of the United States to the countries in Europe, Middle East, and Asia that most all are bordered on all sides, we again are fortunate for this reason to have had limited access with terrorist.

We are known as the Land of the Free, Home of the Brave, and the Melting Pot. Brave men and woman have fought and died for the rights and freedoms we hold so dear. We stand by our Constitution and the Declaration of Independence that proudly states, “We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights that among these are Life,

Liberty and the pursuit of Happiness.”<sup>275</sup> The United States has made the right decisions beginning with our foundation of proud men and woman who wanted freedom and the right to worship as they desired. We built our country as a Christian nation weaving our fabric with laws and with anyone who was willing to obey the laws even though they may disagree. When we need to change the laws, we have a legal system that today allows anyone who desires to vote, voice their opinion, disagree in a constructive manner, and make a difference. Our country was built on the right to become whatever you are willing to work for and stand for what you believe in.

However, there are those who believe the United States is wrong and the United States should change everything we fought for and believe in. They, the terrorists, ISIS, al Qaeda, all cowards that are now finding their way across our borders and into our cities, believe a different way. They believe in a way of inflicting fear and brutality to force their beliefs on everyone else. The world has seen these abhorred and repulsive acts of torture, beheading, burning people alive, floggings, burying people alive, and crucifixions. These groups are no respecter of age or gender when, without thought, and with enjoyment delve out these actions and videos the victims as they suffer a horrendous death, only to later broadcast it to the world. They seek out those who believe differently, they go to their homes and villages, especially the “People of the Cross,” those who proudly declare their Christianity, and kill them for that very reason.<sup>276</sup>

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<sup>275</sup> Constitution Society, United States Declaration of Independence, accessed May 1, 2015, [http://www.constitution.org/us\\_doi.pdf](http://www.constitution.org/us_doi.pdf).

<sup>276</sup> Jamie Dean, “The ISIS War Against ‘The People of the Cross’,” *World*, February 17, 2015, accessed May 12, 2015, [http://www.worldmag.com/2015/02/the\\_isis\\_war\\_against\\_the\\_people\\_of\\_the\\_cross](http://www.worldmag.com/2015/02/the_isis_war_against_the_people_of_the_cross).

Not only are these cowards, who are the most evil form of life coming across our borders, but also there are those in our country who choose to convert to this distorted radical Islamic movement and go overseas to stand with them to perform the same despicable acts of violence.

This author believes a new law should be passed immediately that strips anyone of their United States citizenship, never to again be allowed back in the United States that voluntarily joins a terrorist organization or fights against the United States. Now some of those cowards are rising up inside our country, those who were already here, an insider threat, people who enjoy the rights and freedoms of the country, and use them against us. We must not only use our might and weapons but also our laws and the legal system to enforce them. We must not waver from the reasoning and beliefs that made us the country we are today. The simplified version of what Abraham Lincoln said in 1858 still rings true today, “America will never be destroyed from the outside. If we falter and lose our freedoms, it will be because we destroyed ourselves.”<sup>277</sup> These are the people, the terrorists that our military, intelligence agencies, law enforcement agencies, APD, freight train police departments, local, state, and federal agencies all are preparing and working 24/7 to stop.

This paper has shown there are capabilities exist that are sufficient to defend our passenger rail system if we choose to implement them. Amtrak’s law enforcement and intelligence agencies that strive to protect the passengers and the railroad are performing an almost impossible task. This author laid out several methods of protection that can be

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<sup>277</sup> Abraham Lincoln Online, “Lyceum Address,” accessed May 12, 2015, <http://www.abrahamlincolnonline.org/lincoln/speeches/lyceum.htm>.

implemented without overwhelming the system. The current layers of protection have been effective so far but according to the FBI Director James Comey, who stated on May 7, 2015, “there are as many as thousands of people inside the United States taking in ISIS’ online poison. We have a very hard task in trying to identify and stop anyone inspired to launch an attack inside the U.S. homeland.”<sup>278</sup> This means the rules are changing, the risk is rising, and we need to be proactive and not reactive. This author believes we have identified the threats and vulnerabilities to our railroad systems, but will need new technologies for protection and the policies that provide the law enforcement agencies the means to mitigate the terrorist plots.

This paper has addressed the question: How are passenger and freight rail most susceptible to terrorists attacks, and how could terrorists create the maximum amount of damage and loss of life? This paper discussed in length the threat of damage and loss of life that could come from a terrorist attack on a freight train transporting loaded tank cars with flammable liquids or toxic chemicals. This is a very difficult vulnerability to mitigate, but this author feels that a strong effort is being made in the necessary areas. The freight companies are identifying those trains that qualify as a High-Hazard Flammable Unit Train and are not only rerouting them around the High Threat Urban Areas but also are accountable for the safest route for any train carrying the tank cars. The routes use a minimum of 27 elements that must be used to find the safest route. Additionally, a new Final Ruling from the DOT implemented on May 1, 2015 that mandated improving the strength of the tank cars to resist rupture and leaks.

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<sup>278</sup> Desoto.

There is another argument in full swing about allowing new pipelines to transport the oil that would reduce the amount of oil moved by rail and trucks that could potentially reduce accidents involving flammable liquids:

Despite the fact that rail-based crude transportation costs more (\$10–\$15 per barrel as against \$5 a barrel through pipeline); crude shippers are compelled to rely on rail-based transport. This is due to the lack of pipeline infrastructural support in key oil and gas fields like Bakken Shale Formation in North Dakota and Montana, Eagle Ford Shale, Barnett Shale and Permian Basin in Texas, the Gulf of Mexico and Alberta oil sand fields in Canada. As a result, inadequate pipeline developments have given rise to higher penetration of railroad transportation for crude oil shipping in these areas.<sup>279</sup>

Shipments by rail are likely to continue to rise if Keystone XL is not built. However, railroads are neither the most efficient nor the safest means of transporting oil. When a freight train hauling crude oil in tank cars jumps the rails, the damage can be devastating – as was the case with the tragic accident in Quebec in July 2013. By comparison, decades of use have proved that pipelines overall are overwhelmingly safe and reliable. Pipelines carry far more crude and have fewer leaks per mile. And when a spill occurs, the repair and clean-up are relatively easy. According to the American Petroleum Institute, over the past 30 years the “spill rate” for pipelines has been only 38 gallons per billion gallons transported. For rail tank cars, the spill rate is 80 gallons. Simply put, North America must build more pipelines. Despite environmental concerns, a pipeline is the safest and most efficient way to transport oil and gas. A point this paper discussed earlier that supports the above argument, is the freight companies have no choice whether to move the oil, they are required by law.<sup>280</sup>

Interesting is the fact that all of the attention and controversy is over only one of four phases of the Keystone pipeline. The proposed section that would run from Hardisty, Alberta, Canada directly to Steele City, Nebraska would only shorten the pipeline and use

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<sup>279</sup> Zacks Equity Research, “Railroad Industry Poised for Improvement,” August 19, 2014, accessed May 15, 2015, <http://www.zacks.com/commentary/33989/railroad-industry-poised-for-improvement>.

<sup>280</sup> Bernard L. Weinstein, Terry L. Clower, and Nicholas J. Saliba, “The Gulf Coast Pipeline System: A Catalyst for American Jobs and Energy Security,” Pipelines International, September 2014, accessed May 3, 2015, [http://pipelinesinternational.com/news/the\\_gulf\\_coast\\_pipeline\\_system\\_a\\_catalyst\\_for\\_american\\_jobs\\_and\\_energy\\_secu/88949](http://pipelinesinternational.com/news/the_gulf_coast_pipeline_system_a_catalyst_for_american_jobs_and_energy_secu/88949).

a larger pipe to an already existing fully operational pipeline that now takes a much longer route from Hardisty to Steele City. This section has already delivered almost 490 million barrels of oil. The other two phases are operational and extend to Houston, Texas through Kansas and Oklahoma, and a phase that runs through Missouri into Illinois to the Midwest refineries.<sup>281</sup>



Figure 5. The Keystone Pipeline System

*Source:* Bernard L. Weinstein, Terry L. Clower, and Nicholas J. Saliba, “The Gulf Coast Pipeline System: A Catalyst for American Jobs and Energy Security,” *Pipelines International*, September 2014, accessed May 3, 2015, [http://pipelinesinternational.com/news/the\\_gulf\\_coast\\_pipeline\\_system\\_a\\_catalyst\\_for\\_american\\_jobs\\_and\\_energy\\_secu/88949](http://pipelinesinternational.com/news/the_gulf_coast_pipeline_system_a_catalyst_for_american_jobs_and_energy_secu/88949).

<sup>281</sup> Weinstein, Clower, and Saliba.

This paper has highlighted the threat of derailment as a method of attack that could cause the most damage and loss of life. Except for approximately 650 miles owned by Amtrak, the freight rail companies are responsible for track integrity throughout the system. The accidents in Lac-Megantic and Granite, South Carolina show what can happen if a train derails in a strategic location. There are approximately 1,450 derailments a year in the United States and this would indicate not only the routes and tank cars need attention but so does the causes of derailment. Most are insignificant but the accidental derailments and massive explosions of tank cars have brought this to the forefront and now needs to be addressed. The freight companies are beginning to use UAV to scout the rails that could enhance the specialized equipment that is now checking the rails. This issue could be a joint effort by the freight rail industry and the Federal government.

This paper brought out how a terrorist could attack a train with tank cars using a high-powered rifle or rocket-propelled grenade. This can only be mitigated by our intelligence community, law enforcements, and the attentive eyes of citizens.

What are the layers of protection available to passenger rail and are they being implemented? Those levels that are in place are excellent and the Amtrak personnel that place themselves on the front line to protect the passengers and employees are to be commended. Those layers consist of:

1. National Communications Center
2. Police Officers
3. K-9 Units
4. Special Operations Unit



5. Intelligence and Counter-Terrorism teams
6. VIPR Teams
7. RAIL SAFE exercise and public awareness campaigns
8. Random searches, screenings, and ID checks
9. Behavior Assessment Screening System

This paper listed nine items that Amtrak does not use but does have the means to implement:

1. No carry-on baggage security checks.
2. No requirement to check baggage 28 x 22 x 14 or under even when baggage checking is available. All airlines would require this size to be checked.
3. No checked baggage security checks.
4. No WTMD-checks for metallic weapons.
5. No AIT-checks for metallic and nonmetallic weapons.
6. No authentication of ID documents.
7. Passengers can purchase tickets after boarding.
8. No restrictions on liquids carried on board.
9. Passenger manifest submitted to DHS-voluntary. Checks for passengers that pose a risk or threat to national security.

This paper also combined and reduced that list into a list of challenges that could be applied to passenger long-distance routes:

1. Amtrak passengers are allowed to purchase tickets after boarding.
2. Amtrak does not authenticate ID documents.

3. Amtrak does not have a No-Ride list. Passenger manifest submitted to DHS is not mandatory but Amtrak voluntarily submits this information for the trains that cross the Canada/United States border. Checks for passengers that pose a risk or threat to national security. This is a policy issue only correctable by the United States Government.

4. Amtrak only has a limited armed presence on the trains and the 500 station locations.

5. Amtrak has no checked baggage screening Amtrak has no WTMD-checks for metallic weapons Amtrak has no AIT-checks for metallic and nonmetallic weapons. Any restriction on liquids brought on board is a decision that could be addressed overnight if needed.

With some adjustments in the operation of Amtrak, these five suggestions could be applied to the long-distance routes without overwhelming the system. These layers of protection could use existing technology that would meet the developing terrorist threats inside the United States borders. There is a feeling being expressed by top intelligence officials that the threat is growing and it will be difficult to stop. These suggestions are ones that are needed before anything happens in order to deter attacks until intelligence can provide the necessary information to intercept and stop attacks. This author feels it is only a matter of time before an attack happens on the railroad system that causes major damage and loss of life. It cannot be expected that the terrorists do not think or see the same vulnerabilities we see; only they see them as opportunities.

This paper has addressed the question: How does the railroad system contribute to the economy, and would an attack on the railroad systems affect the economy?

This research reports that Amtrak is not a government agency, but a government owned for-profit corporation that operates intercity passenger rail services to over 500 destinations in 46 states, District of Columbia, and three Canadian provinces. Amtrak is the only long-distance route passenger train service in the United States. Amtrak reported during fiscal year 2014, the total number of passengers was over 31 million, an average of more than 86,000 passengers on over 300 trains per day, on over 21,300 miles of track. Amtrak carried more than three times as many passengers on the route from Washington, DC to New York and the route from New York to Boston than did all of the airlines combined. In less than 400 miles of track, Amtrak carries nearly two-thirds of its passengers between ten metropolitan areas.

Amtrak reports that there are 2,200 commuter trains using Amtrak-owned infrastructure on the NEC with an average weekday ridership of 750,000. Amtrak has 23 tunnels consisting of 18.6 miles of track and 1,209 bridges consisting of 42.5 miles of track on the NEC. Of these bridges, 14 of them are moveable bridges between Washington and Boston.<sup>282</sup>

Amtrak consistently runs a deficit with expenses normally exceeding revenues by over one billion dollars a year. There is always an outcry of poor management and there probably is some truth to that but,

Amtrak's poor revenue should not be evaluated as a reflection of poor management, because no publicly operated passenger rail system in the world has a profitable revenue stream. The poor financial performance of passenger rail services has led to underinvestment. Unlike freight railroads, (reinvesting \$29 Billion in 2015) Amtrak has no profits to reinvest in maintenance, much less in ambitious capital projects that would make American passenger rail services truly globally competitive. According to the Organization for Economic Cooperation

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<sup>282</sup> Amtrak, "National Fact Sheet FY 2013."

and Development (OECD), the United States must invest an additional \$230 billion between 2015 and 2030 to restore its rail infrastructure to a level of global competitiveness.<sup>283</sup>

In Amtrak's FY 2015 budget request to Congress, Amtrak is seeking a change in federal passenger rail investment and warns that continuation of current funding levels leave Northeast Corridor infrastructure vulnerable to a bigger, costlier and far more damaging failure than anything yet seen. "Infrastructure deterioration and changes in business patterns have reached a point where something has to change," said President and CEO Joe Boardman. "If America wants a modern intercity passenger rail system, the problems of policy and funding must be addressed." "Increased ridership, enhanced operating performance, and stronger financial management are part of an improving Amtrak. It is time to consider a new paradigm for federal financial support," said Tony Coscia, Amtrak board chairman. "The reality is that status quo federal funding levels put the Northeast Corridor infrastructure at increased risk of major failure with serious economic consequences for the nation." "The nation cannot afford to let a railroad that carries half of Amtrak's trains and 80 percent of the nation's rail commuters fall apart," Boardman stressed, noting the NEC is vital to the mobility, connectivity, and economy of the entire Northeast region.<sup>284</sup>

The above are powerful statements and warnings, and if that is the case then those in Congress will have some critical decisions to make on reinvesting in the only national passenger rail service in the United States. It would be the hope that these statements have overestimated the efforts and funding required that would return the United States passenger rail service as a whole to where it needs to be. As the nation's long distance carrier, a disruption in service would be a great inconvenience and a major disruption in service would affect the economy but not on the level as would the freight rail system. However, a major disruption in service of commuter/transit carriers, which Amtrak

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<sup>283</sup> Rosabeth Moss Kanter, *Move: Putting America's Infrastructure Back in the Lead* (New York: W. W. Norton and Company, 2015).

<sup>284</sup> Amtrak, "Amtrak FY 2015 Budget Request Seeks Change in Federal Passenger Rail Investment," March 18, 2014, accessed July 14, 2014, <http://www.amtrak.com/ccurl/412/537/Amtrak-FY2015-Federal-Budget-Request-ATK-14-028,0.pdf>.

serves as the main commuter/transit carrier in the NEC, would create a significant impact on the nation's economy.

In December of 2014, the AAR reported that the nation's freight railroads spent \$28 billion of their own funds, not taxpayer dollars, to build, maintain, and upgrade their nationwide rail network. In 2015, that amount is projected to grow to \$ 29 billion to continue to fund those same areas of development. Over the past 35 years, the freight railroads have infused approximately \$575 billion into the rail system in an effort to conduct a continuous upgrade program for its infrastructure.<sup>285</sup> In 2014, the freight railroads were committed to hiring approximately 12,000 employees, but by years end had exceeded that number and actually hired over 17,000 new employees. Between 2012 and 2014, the railroad hired 45,000 people including an estimated 9,900 men and women with military service.<sup>286</sup>

The research has discussed the value that the freight rail companies bring to the economy of the United States. Since the Staggers Rail Act was passed in 1980 removing deregulation, the freight rail companies have greatly prospered and made the United States freight rail system the top rail system in the world. The TSA describes the freight railroads as a provider that serves nearly every industrial, wholesale, retail, and resource-based sector of the United States economy, and is responsible for transporting a majority of goods and commodities that Americans depend on daily. The DOD reports that the United States freight rail system, a \$70 billion industry, moves more freight than any

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<sup>285</sup> Association of American Railroads, "Overview of America's Freight Railroads."

<sup>286</sup> Association of American Railroads, "Freight Railroads Continue Major Hiring Drive, Strong Focus On Veterans."

other freight rail system worldwide but also provides 185,000 jobs across the country. Compared to the other modes of transportation, the railroad accounts for and leads the way with 40 percent of intercity freight volume.

This paper addressed the question of what would be the impact to our nation's economy if a terrorist attack caused delays or even shut down major portions of the railroad system for even a short period. The FRA reports over 90 percent of products moved by rail freight include agriculture and energy products, automobiles, construction materials, chemicals, coal, food, and metals. Coal is the most important single commodity carried by rail. The vast majority of coal in the United States is used to generate electricity at coal-fired power plants. Coal accounts for approximately 40 percent of all United States electricity generation, more than any other fuel source, yet is now decreasing since 2006, and railroads handle approximately two-thirds of all United States coal shipments.<sup>287</sup> Many other resource providers use the railroads, and depend on the system for timely shipping and receiving of their raw materials and finished products.

This research has shown that there would be a significant impact on the economy if a large portion of the freight system were to be disrupted. The resiliency of the freight railroad would overcome any minor or regional disruptions as seen by the railroads response during natural disasters. This author feels that the only way a large portion of the railroad system could be disrupted for any length of time would come by a cyber-attack. Unfortunately, the cyber-attack would not have to be directed at the railroad systems, but the major disruption could be a second or third order affect from an attack

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<sup>287</sup> Association of American Railroads, "Overview of America's Freight Railroads."

on the critical energy industry. Disrupting the power grid would affect the fuel and power needed to operate the railroad system both passenger and freight.

This paper has tried to evaluate the vulnerabilities of the passenger and freight railroad systems and the most likely and most dangerous course of action that would be taken by the enemy to attack these systems. Analyzing the strengths and weaknesses of each system and what could be used as a weapon or method of attack is critical. This must include comparison of the terrorist attacks in the United States and the number of terrorists attacks in other countries. It must not only include countries that have similar political systems but also completely opposite systems and how that seems to affect the rate of terrorist attacks. Without a doubt, innovation in technology will play a large role in protecting out systems, but equally important is the ability of the intelligence community to gather, analyze, and share the right information at the right time.

## CHAPTER 5

### CONCLUSIONS AND RECOMMENDATIONS

The security and safety of the American mass and commercial transportation systems has been the focus of intense scrutiny in the post-9/11 era. Significant infrastructure and systemic improvements designed to reduce vulnerability to terrorist threats are apparent in the air and sea modes but less so in rail. The purpose of this research was to focus specifically on the vulnerability of the United States railroad system to terrorist attacks. This study considered the different methods the United States utilizes to identify security vulnerabilities of the railroad system to terrorist attacks, assess risks, and examined what steps have been taken to mitigate these potential violent and illegal activities. This study demonstrates a narrowed research effort that specifically targeted four areas of rail operations as well as three supporting areas of focus: Long-Distance passenger rail (Amtrak), freight rail, derailment, tank cars, cyber-attacks, global comparison, and technology. The table below summarizes the finding of seven areas of study.



Table 13. Findings and Recommendations

Area of Study	Problem	Recommendations	Feasibility Rank 1-5 See note in source line	Is Problem /Solution currently being considered
Passenger Rail Amtrak	1)On Board ticket Purchase 2) No Ride List 3)Authenticate ID 4) Need for a larger Visual and Armed Presence  5)Passenger/Baggage Screening	1) Discontinue  2) Implement on Long Passenger routes 3)Use of Ultraviolet equipment 4) ) Additional Amtrak Officers, Rail Marshals, or Armed Crew 5) Begin screenings for passenger and all baggage on Long Passenger routes. Utilize Advanced Imaging Technology detectors and new technology such as Stand-off screening when available.	1) 1 2) 3-this would require a policy change at the Federal level 3) 2  4) 3  5) 4	No No  No  No
Freight Rail	1)Multiple Crossing Incidents 2) Derailments	1a)New Communication Policy 1b)On Board Radar System 2) see Derailments below	1) 3  1) 4	1a)No  1b)No
Derailment	Average 1,450 Derailments annually	1) Increase checks and Monitoring on rails. Use of UAV's 2) Reduce Speed	1) 3  2) 1	Yes  Yes
Tank Cars	1)Rupture/Leak 2) Reduce risk of Derailments involving Tank Cars	1)Strengthen 2) Increase Nations Pipeline Infrastructure for movement of oil	1) 4  2) 4	Yes  Yes/Stalled

Cyber- Attacks  <b>Most Dangerous Threat</b>	Disruption in Service	a)Direct all available resources and efforts to Cyber Security b)Collaboration with Federal Government	a) 5  b) 2	Yes  Yes
Global Comparison	Deterring Terrorist attacks on U.S. railroads compared to five other countries is strong but unchallenged.	A stronger visual presence and focus on intelligence	3	Yes
Technology	Not meeting security needs for the railroad industry	Set Deadlines for development on matters of National Security	4	No

*Source:* Created by author. Note: Feasibility is based on the following elements: cost, equipment, personnel, policy change, and time needed for implementation. Ranking 1-5 with 1 requiring the least amount of the elements.

### Findings and Recommendations

This research paper demonstrated that United States passenger rail and Amtrak's Police Department have strong levels of protection. The protection levels have been evaluated through the concept of a risk-based analysis methodology and prioritizing. This country has been effective in planning, preparing, and deterring against terrorist attacks on the railroad system, but the question is, have we been challenged and if not will our efforts stand up to the challenge. This country has also been fortunate that another attack on our transportation systems has not happened since 2001.

The United States was not prepared for suicidal terrorist hijackings with civilian aircraft but the threat was not unknown to air transportation planners and operators within

the government and also the private sector. As mentioned earlier the TSA Office of Intelligence, *Freight Rail Threat Assessment* of 2011 was released in 2014. “TSA-OI has no specific, credible intelligence to suggest violent transnational or domestic extremist groups are planning to attack the U.S. freight rail system, or use the system to facilitate an attack against another target. TSA-OI assesses with moderate confidence that the risk of an attack to the U.S. freight rail industry is low.”<sup>288</sup> The above statement is very similar to one made a few months before the attacks on the United States on September 11, 2001:

The 9/11 Commission determined that the FAA had indeed considered the possibility that terrorists would hijack a plane and use it as a weapon. In the spring of 2001, the agency’s intelligence function, the Office of Civil Aviation Security, distributed an unclassified CD-ROM presentation to air carriers and airports, including authorities at Logan, Newark, and Dulles. The briefing, whose overall subject was the increased threat to civil aviation, mentioned the possibility of suicide terrorist hijacking but concluded that; fortunately, we have no indication that any group is currently thinking in that direction.<sup>289</sup>

This author has been an Air Traffic Controller at the Kansas City Air Route Traffic Control Center for 29 years and was working the day of September 11, 2001. In the Kansas City Air Route Traffic Control Center area, our responsibilities that day with the air carriers were to verify none of the aircraft under our control was under attack, to keep the pilots informed, allow them time to communicate with their dispatch, even if this meant putting them into a holding pattern, and directing them to one of the closest major airports (Kansas City, Wichita, Oklahoma City, Tulsa, Springfield, Missouri, St.

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<sup>288</sup> Transportation Security Administration, Office of Intelligence, Transportation Analysis Branch, “(U) Freight Rail Threat Assessment.”

<sup>289</sup> National Commission on Terrorist Attacks on the United States, *9/11 Commission Report*, National Archives and Records Administration, accessed May 23, 2015, <http://www.9-11commission.gov/report/911Report.pdf>.

Louis, and Chicago). The security of the smaller aircraft and business jets was also verified and were then informed that this was a national emergency and that they would be required to land at the nearest airport. That day in the United States, approximately 4,500 aircraft were directed to land within 90 minutes. This was unprecedented and there was no established plan for such a situation. The ability of the air traffic controllers and managers to quickly develop a shared understanding of what was required and the disciplined initiative to implement an untested national response to meet an unparalleled event, attest to their professionalism, adaptability, and extraordinary skills.

Many lessons were learned that day and some actions could have been performed better, but time was short and procedures had not been established for this situation. The 9/11 Commission states:

In sum, the protocols on 9/11 for the FAA and NORAD to respond to a hijacking presumed that:

The hijacked aircraft would be readily identifiable and would not attempt to disappear.

There would be time to address the problem through the appropriate FAA and NORAD chains of command.

The hijacking would take the traditional form: that is, it would not be a suicide hijacking designed to convert the aircraft into a guided missile.

On the morning of 9/11, the existing protocol was unsuited in every respect for what was about to happen.<sup>290</sup>

The defense of U.S. airspace on 9/11 was not conducted in accord with preexisting training and protocols. It was improvised by civilians who had never handled a hijacked aircraft that attempted to disappear, and by a military unprepared for the transformation of commercial aircraft into weapons of mass destruction. As it turned out, the NEADS (Northeast Air Defense Sector) air

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<sup>290</sup> National Commission on Terrorist Attacks on the United States, *9/11 Commission Report*.

defenders had nine minutes' notice on the first hijacked plane, no advance notice on the second, no advance notice on the third, and no advance notice on the fourth.

We do not believe that the true picture of that morning reflects discredit on the operational personnel at NEADS or FAA facilities. NEADS commanders and officers actively sought out information, and made the best judgments they could on the basis of what they knew. Individual FAA controllers, facility managers, and Command Center managers thought outside the box in recommending, a nationwide alert, in ground-stopping local traffic, and ultimately, in deciding to land all aircraft and executing that unprecedented order flawlessly.<sup>291</sup>

The efforts made that day by everyone involved trying to stop the attacks and attempting to save lives, including those already mentioned, the pilots, passengers, first responders, and civilians who responded, many giving the ultimate sacrifice, was nothing short of heroic.

This author and Air Traffic Controller/Supervisor suggests that the FAA continues to brief the controllers and management on the actions and decisions made that day, and how that situation would be handled today. Many lessons were learned from that national event and a new generation of managers and controllers are now filling the chairs that watch over and guide the airplanes. Those lessons learned and the changes in protocol should be kept fresh in everyone's minds. The DOD and the FAA are now ever watchful and well prepared if such an event should ever happen again.

Acknowledging the past can protect you from perils of the future. The current question for this paper is: Has the railroad industry learned from the experiences of 9/11 and are they prepared for such an event? This analysis found that there are areas that would benefit from increased security in the passenger rail system. The means currently

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<sup>291</sup> National Commission on Terrorist Attacks on the United States, *9/11 Commission Report*.

exist to strengthen and implement these additional levels of protection. These areas would be carry-on and baggage security checks, AIT for passenger screening, No-Ride list, PreCheck equivalent program, authentication of ID documents, increased visual and armed presence, and ceasing the onboard ticket purchase. This author feels that implementing these levels of protection and implementing new technologies as they arrive for faster baggage and passenger scans can help meet the new challenges of terrorist threats.

In addition to the more obvious security threats to rail operations, other potential vulnerabilities exist including derailments. Over the last 10 years, there have been approximately 1,450 annual derailments<sup>292</sup> and a few of those have caused major damage and loss of life such as the Lac-Megantic derailment.<sup>293</sup> Efforts are being made to make the delivery by rail of flammable liquids and toxic chemicals as safe as possible. As long as the freight industry has no choice but to deliver these products and the option of additional pipelines is not available, there must be a continued concerted effort for the safe delivery of these to their destinations. The concern of intentional derailment of a train transporting loaded tank cars at a strategic location in a populated area ranks high on the list of attacks that would create the most damage and loss of life. New technologies such as the UAV or UAS could reduce cost in verifying the elements of the infrastructure are maintained and secure. New systems for communication between the trains and the local authorities responsible for the rail crossings and new technology for onboard Radar

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<sup>292</sup> Federal Railroad Administration Office of Safety Analysis, “Freight/Passenger Operations Ten Year Overview.”

<sup>293</sup> Transportation Safety Board of Canada, *Lac-Megantic Runaway Train And Derailment Investigation Summary*.

can mitigate terrorist threats in that arena. The new PTC system that brings Automatic Braking Systems to not only freight but also passenger trains will bring a level of safety that will be welcomed by both industries.

Preliminary results from an NTSB official indicates that the Automatic Braking System would have prevented the Amtrak train derailment in Philadelphia that killed eight and injured approximately 200 passengers.<sup>294</sup> This author feels that the Lac-Megantic train disaster would not have been prevented by PTC technology under the circumstances of the train slowly picking up speed in a seven-mile span before derailing.

The United States rail freight system that crosses our country and serves nearly every industry is held up as a global model of efficiency and is essential to not only the United States economy but the global economy as well. As the freight companies are private, the United States depends on them to maintain and protect a majority of the railroad infrastructure with technology such as PTC that is now the focus in 2015.

### Risk Mitigation

Based on our nation's insatiable demand for material delivery, practical and substantially unfettered rail operations are a given. Our current method of risk management and prioritizing is the method used throughout our government at every level and every agency. As the threats change so must our levels of protection. What has worked and has been sufficient up to this point may not suffice for the new threats that are now within our borders. Reevaluating our security priorities and allocation of funds, new technologies, and a demand and timelines for innovation are necessary to keep the

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<sup>294</sup> Jansen.

rail system safe. Can our levels of protection be expected to stop every situation and possibility of a terrorist threat? The answer to that question is obviously no, but we can expect the efforts to anticipate new methods of attack by observing what happens globally.

This paper has shown what challenges and threats some countries must fight every day. Some have attacks on a monthly basis, a majority without death or injury but the few attacks that do succeed in reaching the goal of mass injuries and deaths cause damage in not only the physical but physiological, social, and economic realms as well. The United States is in collaboration with other countries, and has agreements with their intelligence networks and security personnel to discuss and exchange best practices and must continue to improve those exchanges of information and development of relationships.

Of all the threats in the different areas discussed in this thesis, this author would suggest the most likely attack would come from an IED placed in a passenger station. That would be the easiest with the current levels of security. Next would be an IED placed on a train or on the tracks creating a bigger effect on a moving train with the intent of derailment. The plot to derail a Via Rail passenger train in 2013 that was exposed and stopped by the FBI is a good example of the type of plan the United States can expect to face. These types of attacks are most prevalent in other countries and are the types that have been successful. The terrorist groups will stick with what works and will pass their knowledge on to those who desire to attack the United States.

Last would be the most dangerous attack and that would be a cyber-attack on our railroad system. As mentioned earlier, a cyber-attack could create a massive disruption in



service whether directed at the railroad system or a secondary effect from an attack on another critical infrastructure such as the energy infrastructure. The DOD has prepared to defend their systems by setting up United States Cyber Command that oversees each of the branches and their individual cyber units. Interesting is that the National Guard is developing a unit for each state since they are restricted to their respective states under Title 32. This is an excellent idea and one that can be used in a Joint effort between the military and interagency. A major cyber-attack that would affect the railroad system would have major effects and implications to the economy and the distribution of goods.

Most all of the opinions reflect the agreement that the railroad system is too vast and open to protect it effectively, resources are limited and risk-based methodology, assessment, and prioritization determines the present levels of protection. “All plans are great until the first shot is fired” is exactly what happened on September 11, 2001. The United States never planned for a hijacker who did not want to negotiate but only had the thought of death and destruction. On that day, the Air Force and Air National Guard rapid response fighter force consisted of only 14 aircraft at seven bases sitting at 15-minute ground alert on 9/11. The role of air defense in the United States had been turned over to the Army National Guard and was reduced to the 14 response aircraft because of risk-based decisions, assessment, and prioritization of funds. Two F-16s were scrambled but due to slow communication of information, they could not arrive in time.

While we have learned from that episode, what have we learned from rail events? This author was unable to determine if the United States does have a comprehensive and centralized plan to deal with a large scale or multiple rail disasters. The real questions to ask are; what is the response when one, two, or several small attacks happen in different

locations against the railroad system? Is the military brought in to protect the Amtrak stations and patrol the tracks, bridges, and tunnels? Do they begin escorts on the freight trains loaded with flammable liquids and toxic chemicals? What is the Plan? Will the funds be reallocated? Yes, they probably will, and the hope is this will never happen. In today's environment of ISIS and insider threats, hope should not be a major part of the solution. If the day ever arrives when there is a need to support the train industry in a massive effort, we must leverage the power of the DHS, the DOD, the DHS, and every other agency with equity in the prevention of potentially lethal harm to our transportation system. Additionally, we must employ the Army Reserve Expeditionary Railway Center. Their expertise in the areas of Transport Operations, Rail Planning, Railway Structure and Reconnaissance, Railway Equipment, Rail Security, and Rail Safety is a vital and untapped resource to be used in a supporting role, and would be accessible for a stronger role if needed.<sup>295</sup>

The most surprising finding in this research was the levels and capabilities of protection not being utilized by Amtrak that are available. This author believes that long-distance routes can implement new levels of protection at a rapid pace and develop new technologies that will benefit both long-distance and commuter trains. The next surprising finding was the extreme threat that cyber-attacks bring to the critical infrastructure. This is certainly in the forefront of most planning conversations at every

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<sup>295</sup> Headquarters, Department of the Army, Army Technical Publication 4-14, *Expeditionary Railway Center Operations* (Washington, DC: Government Printing Office, May 2014), accessed May 14, 2015, [http://armypubs.army.mil/doctrine/DR\\_pubs/dr\\_a/pdf/atp4\\_14.pdf](http://armypubs.army.mil/doctrine/DR_pubs/dr_a/pdf/atp4_14.pdf).

level, but new policies must be implemented to remove the restrictions of the sharing of information about system vulnerabilities and the actions needed to correct them.

### Additional Research

This author recommends that further study be done on the military and its vulnerability to attack by use of the railroad system. I am fortunate to have been on an Army Base for almost a year. I have seen the different types of traffic that move around the base and the efforts to protect the perimeter. I have also seen a freight train make an almost daily trip inside the fences of the base. Are the approximately 190 bases protected from this access? Could someone walk down the tracks onto the base or get on the train at a previous stop and then ride onto the base?

Worth noting is the DOD's National Defense Program that ensures the nation's rail and highway infrastructure can support defense emergencies. The military is dependent on the railroads to connect bases and installations that will allow the movement of military equipment from "fort to port"<sup>296</sup> when required. In order to have the needs and interests of the military heard by the railroad industry, the Military Traffic Management Command will identify key rails and facilities that are important to the DOD and national defense. Collaboration with the railroad industry will reassure that those rails and facilities are maintained to support the movement of the military equipment. The military has identified approximately 38,000 miles of rail they feel is necessary to support their efforts. This network of rails called, the Strategic Rail Corridor Network also includes the rails that provide the ability to transition between the

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<sup>296</sup> Fort to Port usually means moving equipment from a military base to an airport or seaport.

approximately 190 defense installations.<sup>297</sup> This author feels that the military railroad system and those who operate it should be part of the solution if a major event happens to the civilian railroad system.

One final suggestion is that the federal government utilizes the DOD in every possible area at every possible opportunity. This is what they do, they gather information, analyze the information, evaluate the enemy and their strengths and weaknesses, create multiple courses of action, evaluate those, pick the best one or a combination of the best ones, and then develop a plan down to the last detail. The Military Decision Making Process is a system that is critical in winning wars abroad, and it can certainly help the United States win the most important war and that war is here at home.

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<sup>297</sup> Global Security, “Strategic Rail Corridor Network (STRACNET).”

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